



Workshop Manual Transporter 2004 ➤

4-cylinder diesel engine								
Engine ID	AXB	AXC	BRR	BRS				

Edition 04.2013



List of Workshop Manual Repair Groups

Repair Group

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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.



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00 – Technical data

1 Engine number, engine data

(VRL005650; Edition 04.2013)

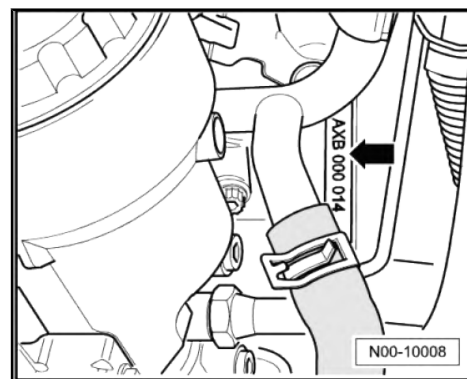
⇒ [“1.1 Engine number, engine data”, page 1](#)

1.1 Engine number, engine data

The engine number -arrow- (“engine code” and “serial number”) can be found at the joint between engine and gearbox.

In addition, there is a sticker on the toothed belt guard with “engine code” and “serial number”.

The engine code is also included on the vehicle data sticker.



Code letters	AXB	AXC	BRR	BRS
Manufactured	03.03 ►	03.03 ►	01.06 ►	01.06 ►
Emissions fulfil	EU3	EU3	EU4	EU4
Capacity l	1.9	1.9	1.9	1.9
Output kW at rpm	77/3500	63/3500	62/3500	75/3500
Torque Nm at rpm	250/2000	200/1600 ... 2400	200/2000	250/2000
Bore Ø mm	79.5	79.5	79.5	79.5
Stroke mm	95.5	95.5	95.5	95.5
Compression ratio	18.0	18.0	18.0	18.0
CN min.	51	51	51	51
Firing order	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2
Exhaust gas recirculation	yes	yes	yes	yes
Turbocharger/supercharger	yes	yes	yes	yes
Particulate filter	no	no	yes (also available without particulate filter)	yes (also available without particulate filter)
Charge air cooler	yes	yes	yes	yes

Volkswagen Technical Site: <http://vwts.ru> <http://vwts.info>



2 Safety instructions

⇒ [“2.1 Safety precautions when working on cooling system”, page 2](#)

⇒ [“2.2 Safety precautions when working on fuel supply system”, page 3](#)

⇒ [“2.3 Safety precautions when working on injection system”, page 4](#)

2.1 Safety precautions when working on cooling system



WARNING

Steam may escape when expansion tank is opened. Wear eye protection and protective clothing to avoid eye injuries and scalding. Cover cap with cloth and open carefully.

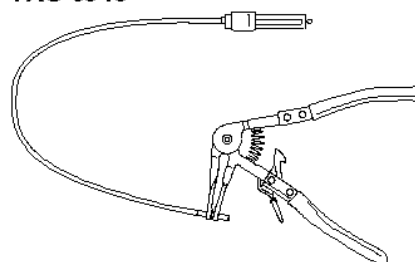


Caution

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- ◆ *Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.*
- ◆ *To avoid damage to lines, ensure sufficient clearance from all moving or hot components.*

VAS 6340

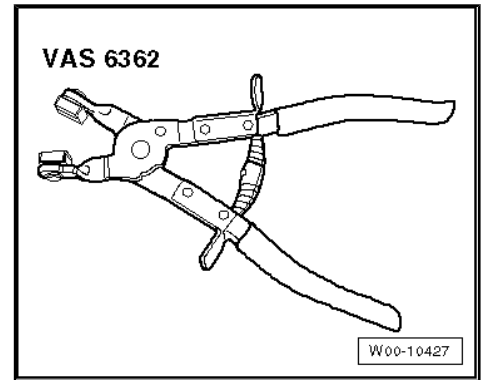


W00-10380



Note

- ◆ *When the engine is warm, the cooling system is under pressure. If necessary, release pressure before beginning repair work.*
- ◆ *Hoses are secured with spring-type clips. In case of repair, only use spring-type clips.*
- ◆ *For fitting spring-type clips, hose clamping pliers - VAS 6340- or*
- ◆ *Hose clip pliers - VAS 6362- .*
- ◆ *When installing coolant hoses, route stress-free so that they do not come into contact with other components (observe markings on coolant connection and hose).*
- ◆ *The arrows on the coolant pipes and on the ends of the hoses must be aligned with each other.*



2.2 Safety precautions when working on fuel supply system



Note

- ◆ *Hose connections are secured with quick-release couplings, spring-type or clamp-type clips.*
- ◆ *Always renew clamp-type clips with spring-type clips.*
- ◆ *Fuel hoses on engine must be secured with spring-type clips only. The use of clamp or screw-type clips is not permissible.*
- ◆ *Spring-type clip pliers - VAS 5024A- or hose clip pliers - V.A.G 1921- are recommended for installation of spring-type clips.*



Caution

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- ◆ *Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.*
- ◆ *Ensure that there is sufficient clearance to all moving or hot components.*
- ◆ *The fuel and the fuel lines in the fuel system can become very hot (danger of scalding)!*
- ◆ *The fuel system is also under pressure! Before opening the system, place cloths around the connections. Then carefully loosen connection to release the pressure!*
- ◆ *Wear eye and hand protection when performing any type of repair work on the fuel system!*

When removing and installing fuel gauge sender or fuel pump (fuel delivery unit) from a full or partly full fuel tank, observe the following:



- ◆ Even before work commences, the extraction hose of an activated fume extraction system has to be placed in the vicinity of the assembly opening of the fuel tank to extract any escaping fumes. If no exhaust gas extraction system is available, a radial fan with a displacement greater than 15 m³/h can be used providing that motor is not in air flow.
- ◆ Prevent skin contact with fuel! Wear fuel-resistant gloves!

2.3 Safety precautions when working on injection system



WARNING

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- ◆ *Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.*
- ◆ *Ensure that there is sufficient clearance to all moving or hot components.*

Note the following if testers and measuring instruments have to be used during a road test:

- ◆ Test and measuring instruments must always be secured to rear seat and operated by a second person from this location.
- ◆ If test and measuring instruments are operated from front passenger seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat may receive serious injuries when the airbag is triggered.

To prevent injuries to persons and/or destruction of the injection and glow plug system, the following must be noted:

- ◆ The ignition must be switched off before connecting or disconnecting injection or glow plug system wiring or tester cables.
- ◆ If the engine is to be turned at starter speed, without starting, e.g. when checking compressions, disconnect unit injector connector on cylinder head.
- ◆ Before disconnecting battery, obtain radio code for radios with anti-theft coding.
- ◆ Disconnecting and connecting the battery must be done only with the ignition switched off because the control unit for diesel direct injection system could otherwise be damaged.



3 Repair instructions

⇒ ["3.1 Rules for cleanliness when working on fuel supply system/injection system", page 5](#)

⇒ ["3.2 Rules for cleanliness when working on charge air system", page 5](#)

3.1 Rules for cleanliness when working on fuel supply system/injection system

When working on the fuel supply and injection system, observe the following "6 rules" for cleanliness:

- ◆ Thoroughly clean all unions and surrounding areas before disconnecting.
- ◆ Place removed parts on a clean surface and cover. Use only lint-free cloths.
- ◆ Carefully cover opened components or seal if repairs cannot be carried out immediately.
- ◆ Install clean components only. Do not remove replacement parts from packing until immediately before installing. Do not use parts that have not been stored in their packing (e.g. in tool boxes etc.).
- ◆ When system is open: do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.
- ◆ Also ensure that no diesel fuel comes into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.

3.2 Rules for cleanliness when working on charge air system

When working on the turbocharger, pay careful attention to the following rules for cleanliness:

- ◆ Thoroughly clean all unions and surrounding areas before disconnecting.
- ◆ Place removed parts on a clean surface and cover. Use only lint-free cloths.
- ◆ Carefully cover opened components or seal if repairs cannot be carried out immediately.
- ◆ Install clean components only. Do not remove replacement parts from packing until immediately before installing. Do not use parts that have not been stored in their packing (e.g. in tool boxes etc.).
- ◆ Existing transport and protective packaging and sealing caps must only be removed immediately prior to installation.
- ◆ When making repairs, remove oil from connection and hose ends.
- ◆ When system is open: do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.



10 – Removing and installing engine

1 Removing and installing engine

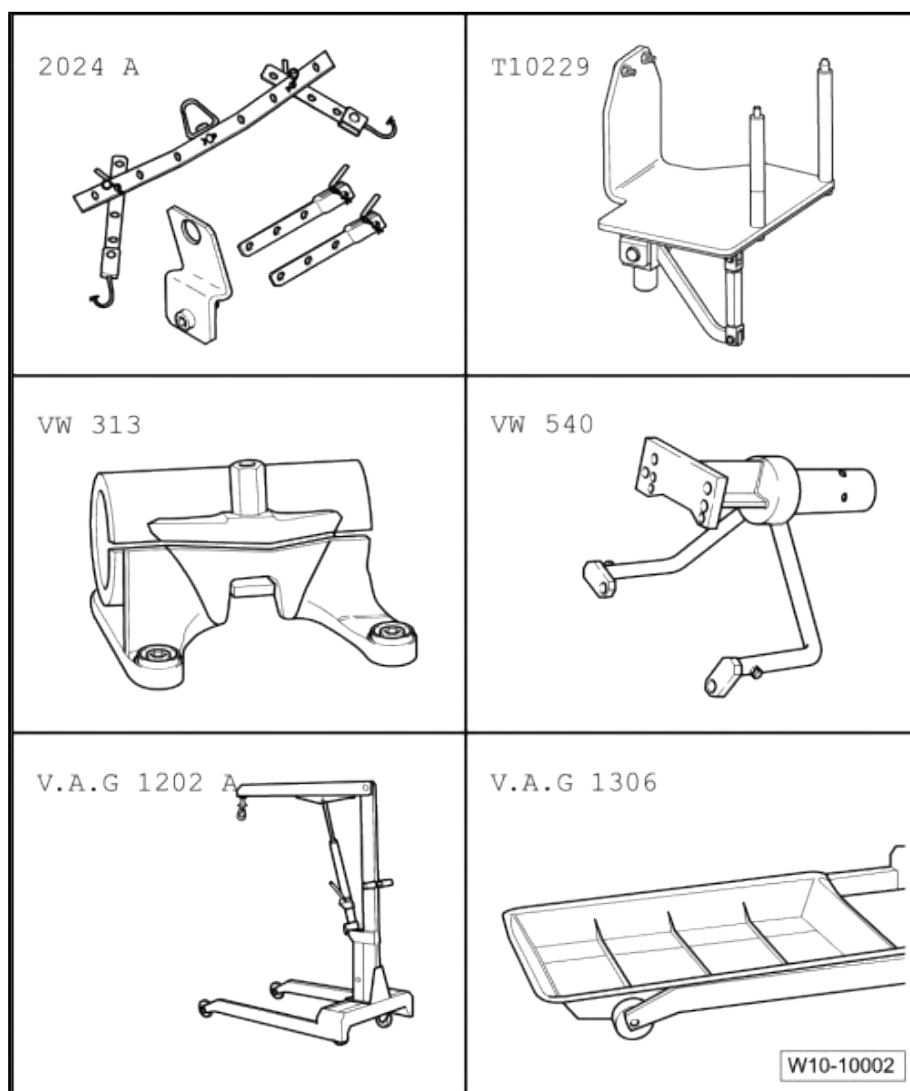
⇒ [“1.1 Removing engine”, page 6](#)

⇒ [“1.2 Securing engine to assembly stand”, page 11](#)

⇒ [“1.3 Installing engine”, page 12](#)

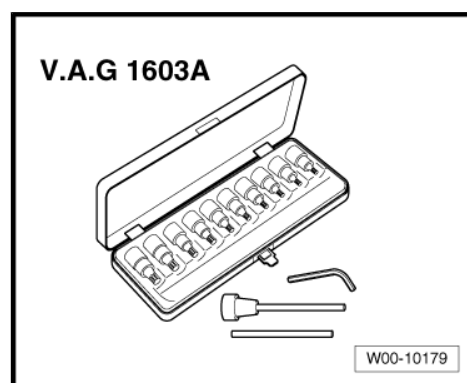
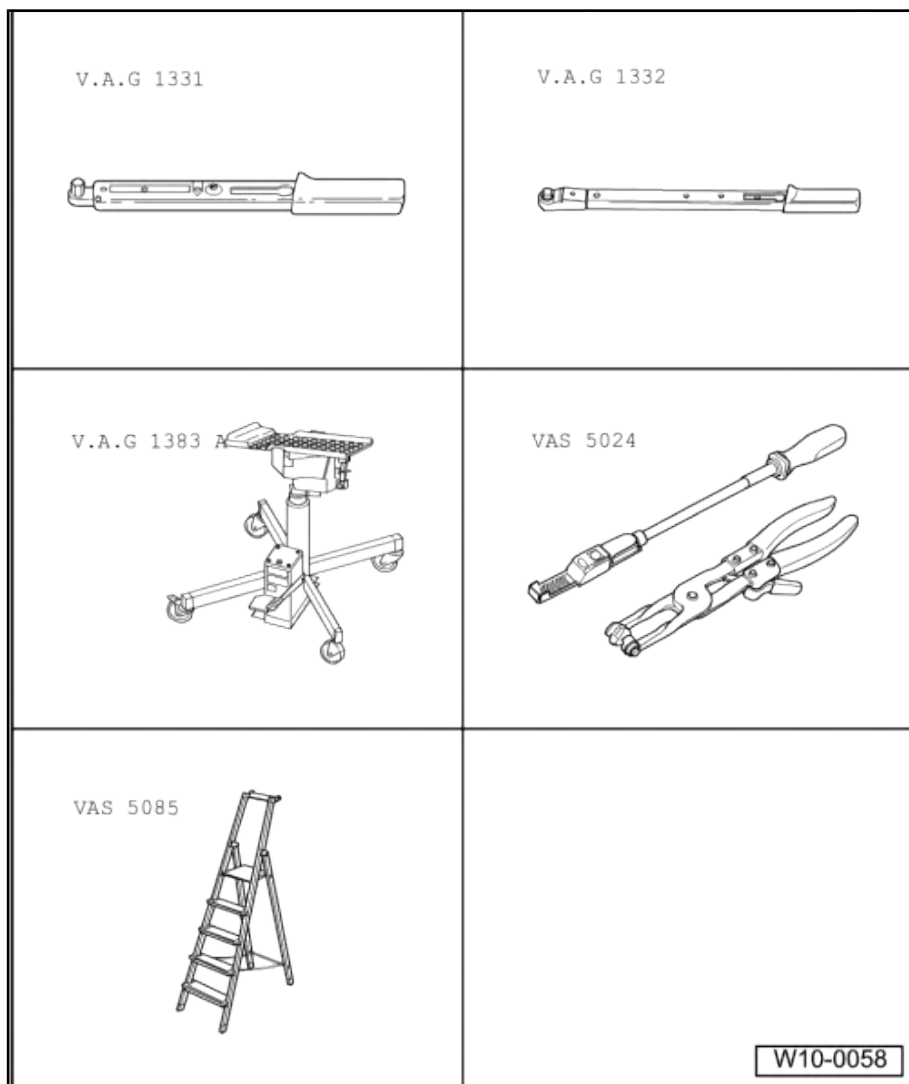
1.1 Removing engine

- ◆ Lifting tackle - 2024 A-
- ◆ Engine support - T10229-
with studs - T10229/1-
- ◆ Support clamp - VW 313-
- ◆ Engine and gearbox support - VW 540-
- ◆ Workshop hoist - V.A.G 1202A- or workshop crane - VAS 6100-
- ◆ Drip tray - V.A.G 1306- or drip tray for workshop hoist - VAS 6208-





- ◆ Torque wrench - V.A.G 1331-
- ◆ Torque wrench - V.A.G 1332-
- ◆ Engine and gearbox jack - V.A.G 1383 A-
- ◆ Spring-type clip pliers - VAS 5024A-
- ◆ Stepladder - VAS 5085-



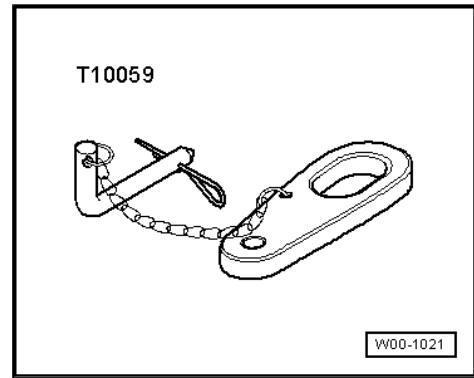


- ◆ Adapter - T10261-
- ◆ Bracket - T10059-



Note

- ◆ *Before carrying out further work, disconnect battery earth strap. For this reason, first check whether a coded radio is fitted. Obtain anti-theft code beforehand if necessary.*
- ◆ *The engine is removed downwards together with the gearbox.*
- ◆ *All cable ties that are opened or cut through when the engine is removed must be renewed/replaced in the same position when the engine is installed.*



Caution

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

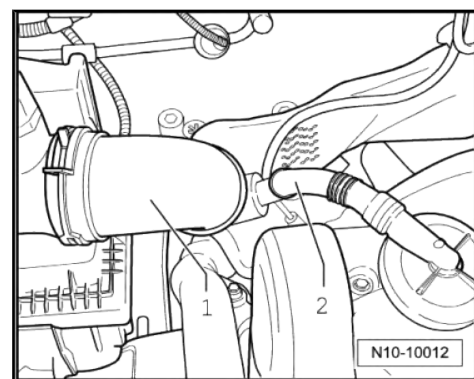
- ◆ *Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.*
- ◆ *To avoid damage to lines/wiring, ensure sufficient clearance to all moving or hot components.*



Note

If large quantities of swarf or metal particles (caused, for example, by partial seizure of the crankshaft or conrod bearings) are found in the engine oil when performing repairs, clean the oil passages thoroughly and renew the engine oil cooler in order to prevent subsequent damage.

- With ignition switched off, disconnect earth strap from battery.
- Remove connecting hoses -1- and -2- from air filter to turbo-charger and pressure regulating valve.
- Remove air filter housing with air mass meter and air duct ➔ [page 154](#) .



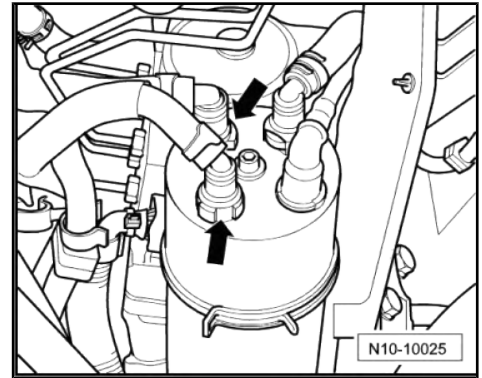


- Unclip fuel supply and return lines at fuel filter -arrows-.



WARNING

- ◆ *The fuel and the fuel lines in the fuel system can become very hot (danger of scalding)!*
- ◆ *The fuel system is also under pressure! Before opening the system place a cloth around the connection. Release pressure by carefully loosening the connection.*
- ◆ *Wear eye and hand protection when performing any type of repair work on the fuel system!*



- Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Body, front; Noise insulation .
- Drain coolant ⇒ [page 108](#) and detach coolant expansion tank.
- Remove connecting pipe -1- with connecting hoses between charge air cooler and turbocharger.
- Remove poly V-belt ⇒ [page 17](#) and tensioning element ⇒ [Item 6 \(page 15\)](#) .
- Remove alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .
- Remove front support mounting of torque reaction support ⇒ [page 14](#) .

Vehicles with air conditioning system:



Note

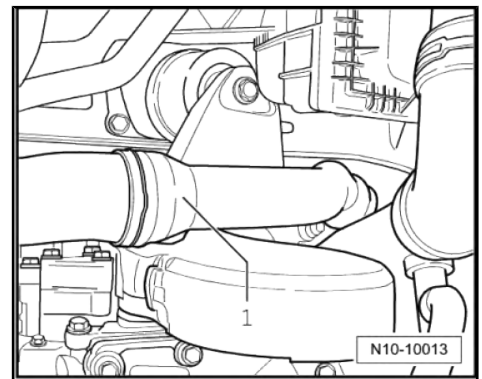
To prevent damage to condenser or to refrigerant lines/hoses, ensure that the lines and hoses are not stretched, kinked or bent.

To facilitate removing and installing engine without opening refrigerant circuit:

- Remove air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor .
- Secure air conditioner compressor to body so that the refrigerant lines are not under tension.

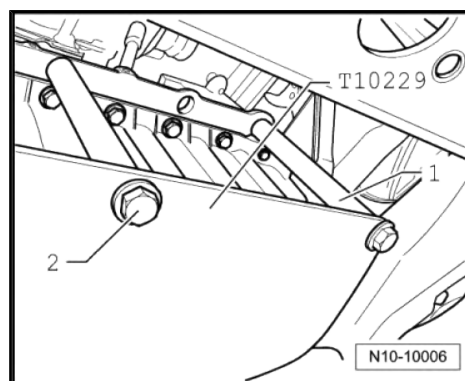
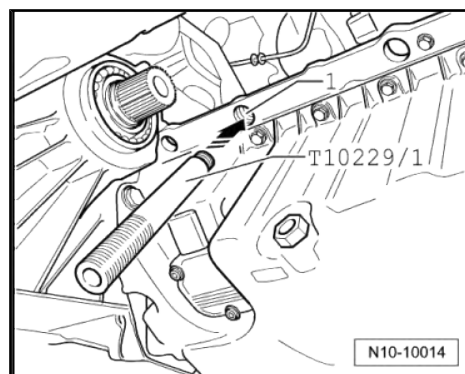
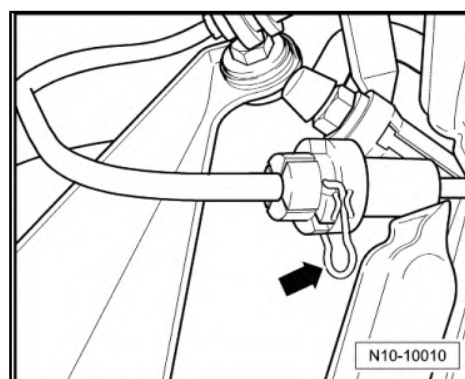
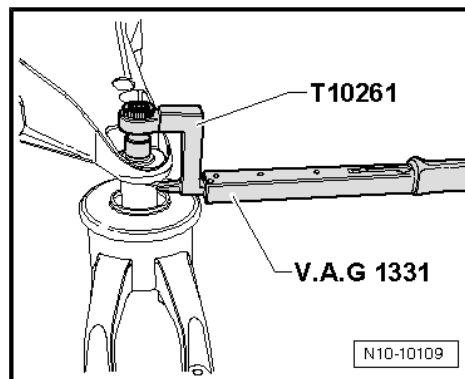
Continuation for all vehicles

- Pull off or disconnect remaining electrical connections as necessary from engine and gearbox and move to one side.
- Remove connecting pipe between charge air cooler and intake connection.
- Remove belt pulley/vibration damper ⇒ [page 15](#) .





- Place adapter - T10261- on central bolt of rear torque reaction support as shown. Unbolt torque reaction support from support mounting.
- Remove right and left drive shafts ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shafts; Removing and installing drive shaft .
- Remove front exhaust pipe ⇒ [page 158](#) .
- Disconnect all connection, coolant, vacuum and intake hoses from engine.
- Pull off or disconnect all other electrical connections as necessary from engine and gearbox and move to one side.
- Unclip line connector at hydraulic clutch slave cylinder -arrow- (pull clip).
- Remove selector mechanism from gearbox ⇒ Rep. gr. 34 ; Selector mechanism .
- Unclip selector cable.
- Screw stud - T10229/1- hand tight into thread -1- on cylinder block.
- Attach engine support - T10229- to stud -1- screwed into the hole in cylinder block. Attach engine support to stud - T10229/1- with bolt M16×35/ 8.8 -2- and tighten to approx. 50 Nm.



Note

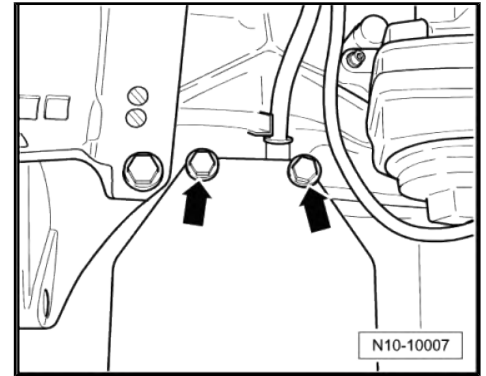
Studs -1- must be secured to engine support - T10229- .



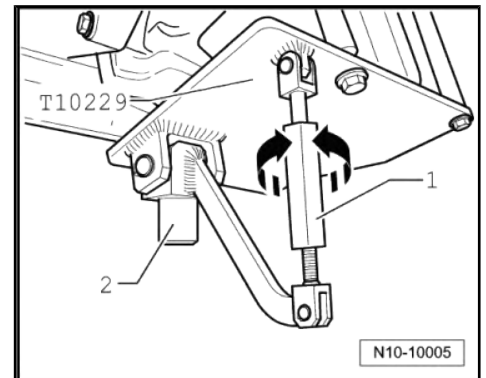
- Bolt engine support - T10229- to front of cylinder block -arrows- with M12×25/ 8.8 bolts.

Specified torque

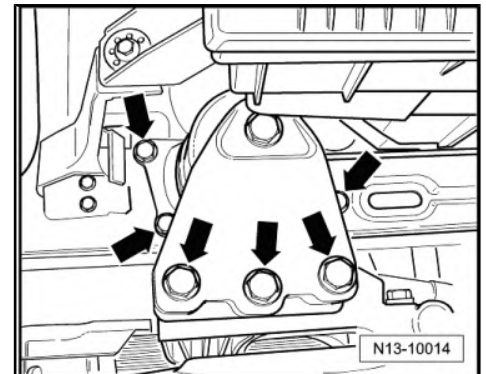
Component	Specified torque
Engine support - T10229- to cylinder block	50 Nm



- Guide engine support - T10229- onto mounting pins -2- on engine and gearbox jack - V.A.G 1383 A- . Raise engine slightly.
- Position engine for removal by turning the adjusting screw -1- to the zero-degree position.



- Unbolt engine side of assembly mounting from above -arrows-.



- Unbolt gearbox side of assembly mounting first from body and then from gearbox -arrows-.



Note

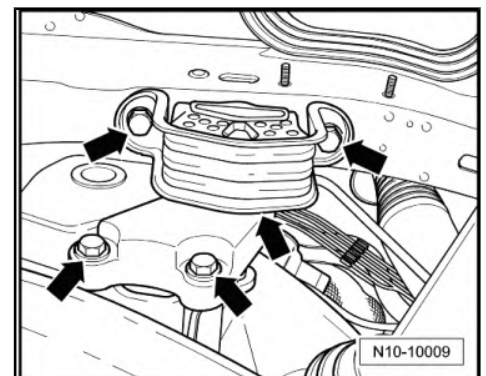
To remove securing bolts use a stepladder - VAS 5085- .

- Carefully lower engine with gearbox.



Note

Engine with gearbox must be guided carefully when lowering to prevent damage to bodywork.



1.2 Securing engine to assembly stand

To carry out assembly work, engine must be secured to support clamp - VW 540- of the assembly stand using engine and gearbox support - VW 313- .



Procedure

- Unbolt gearbox.
- Attach lifting tackle - 2024 A- using shackle - T10059- as follows and lift out of engine and gearbox jack - V.A.G 1383 A- using workshop crane.

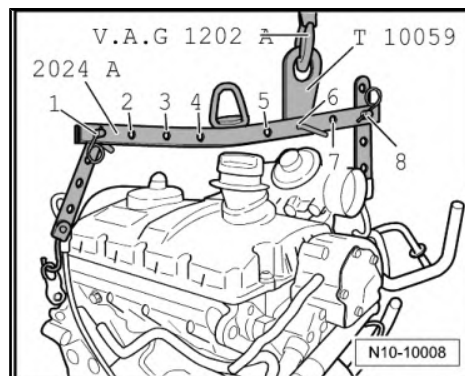
Belt pulley end: 4th hole in hook rail at position 1

Flywheel end: 3rd hole in hook rail at position 8



WARNING

The hooks and locating pins must be secured with locking pins.



Note

- ♦ *The positions marked 1...4 on the bar must face the belt pulley.*
- ♦ *The holes in the hook rails are counted up from the hook.*
- Secure engine to support clamp - VW 540- using engine and gearbox support - VW 313- .

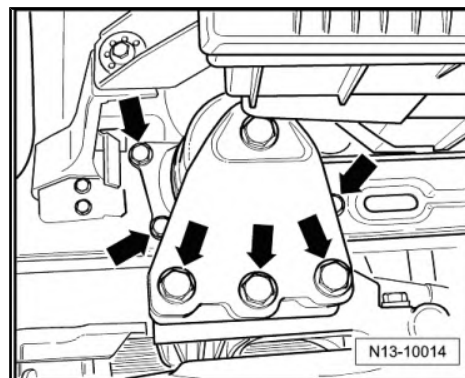
1.3 Installing engine

Installation is carried out in the reverse order; note the following:

- Check clutch release bearing for wear and, if necessary, replace (gearbox removed).
- Lightly grease input shaft splines with grease ⇒ Electronic Part Catalogue (ETKA) (gearbox separated).
- Check whether dowel sleeves for centring engine with gearbox are in cylinder block and install if necessary (gearbox removed).
- Align engine mountings stress-free by rocking, if necessary loosen the engine mountings on the body.

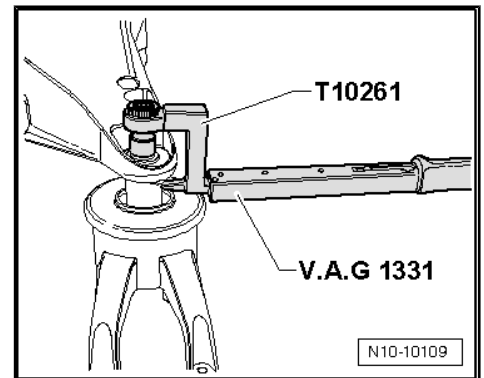
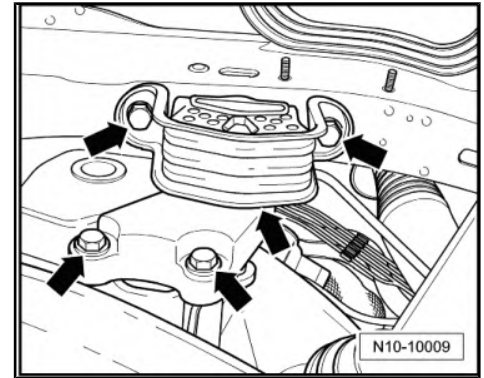
Procedure

- Install engine with engine support - T10229- in the zero-degree position.
- Install engine side of assembly mounting from above -arrows- using new bolts..





- Install gearbox side of assembly mounting first to gearbox and then to body -arrows- using new bolts.
- Install drive shafts ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shafts; Removing and installing drive shaft .
- Install front exhaust pipe ⇒ [page 158](#) .
- Connect line with plug-in connector to slave cylinder of hydraulic clutch.
- Install gear selector mechanism ⇒ Rep. gr. 34 ; Selector mechanism .
- Attach (clipped) gear selector cable.
- Place adapter - T10261- on central bolt of torque reaction support as shown. Tighten torque reaction support to support mounting.
- Install air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor .
- Install front support mounting with torque reaction support ⇒ [page 14](#) .
- Install alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .
- Install poly V-belt ⇒ [page 17](#) .
- Install tensioning element ⇒ [Item 6 \(page 15\)](#) .
- Install noise insulation, if removed ⇒ General body repairs, exterior; Rep. gr. 50 ; Body, front; Noise insulation .
- Replenish coolant ⇒ [page 108](#) .
- Carry out road test and read event memory ⇒ Vehicle diagnostic tester.



Specified torques

- ◆ ⇒ [“2.1 Assembly overview - assembly mountings”, page 14](#)
- ◆ ⇒ [“1.1 Assembly overview - poly V-belt drive”, page 15](#)
- ◆ ⇒ [“3.1 Assembly overview - air filter”, page 154](#)
- ◆ ⇒ [“1.2 Assembly overview - silencers/particulate filter”, page 159](#)
- ◆ ⇒ [“1.1 Assembly overview - silencers/catalytic converters”, page 158](#)
- ◆ Drive shafts; Assembly overview - drive shafts ⇒ Rep. gr. 40 ; Assembly overview - drive shafts .
- ◆ Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 50 ; Assembly overview - noise insulation



2 Assembly mountings

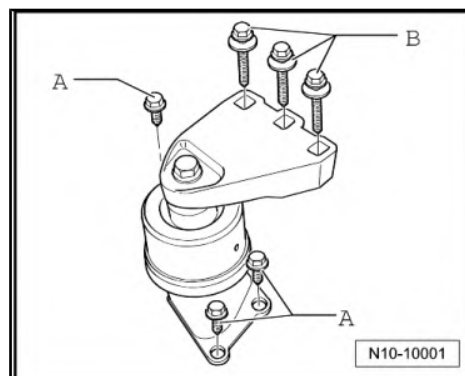
⇒ "2.1 Assembly overview - assembly mountings", page 14

2.1 Assembly overview - assembly mountings

Engine assembly mountings

Specified torque

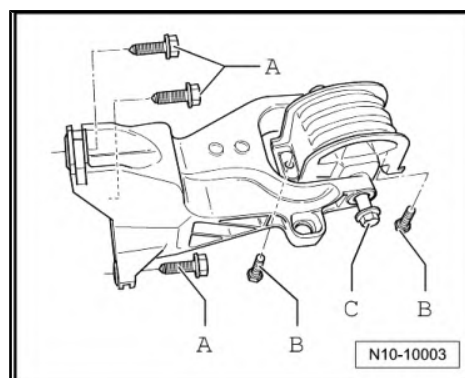
Component	Specified torque
Bolt -A- (renew)	50 Nm + 90°
Bolt -B- (renew)	50 Nm + 90°



Front support mounting with torque reaction support

Specified torque

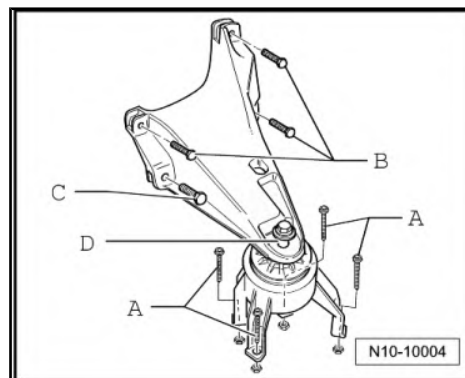
Component	Specified torque
Bolt -A- (renew)	50 Nm + 90°
Bolt -B- (renew)	20 Nm + 45°
Bolt -C- (renew)	90 Nm + 180°



Rear support mounting with torque reaction support

Specified torque

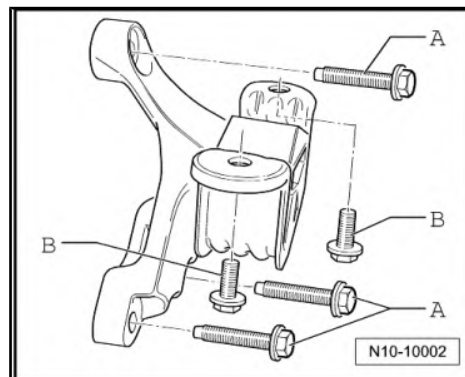
Component	Specified torque
Bolt -A- (renew)	20 Nm + 180°
Bolt -B- (renew)	20 Nm + 90°
Bolt -C- (renew)	50 Nm + 90°
Bolt -D- (renew)	50 Nm + 180°



Gearbox assembly mounting

Specified torque

Component	Specified torque
Bolt -A- (renew)	50 Nm + 90°
Bolt -B- (renew)	50 Nm + 45°





13 – Crankshaft group

1 Cylinder block (pulley end)

⇒ “1.1 Assembly overview - poly V-belt drive”, page 15

⇒ “1.2 Assembly overview - crankcase”, page 16

⇒ “1.3 Removing and installing poly V-belt”, page 17

⇒ “1.4 Renewing crankshaft oil seal - belt pulley end”, page 20

⇒ “1.5 Removing and installing sealing flange on pulley end”, page 22

1.1 Assembly overview - poly V-belt drive

1 - Poly V-belt

- ☐ Mark direction of rotation before removing.
- ☐ Check for wear.
- ☐ Do not kink.
- ☐ Removing and installing ⇒ page 17 .

2 - Bolt

- ☐ 10 Nm + 90°

3 - Cover

4 - Belt pulley and vibration damper

- ☐ Can only be installed in one position. Holes are offset.

5 - Bolt

- ☐ 25 Nm

6 - Poly V-belt tensioning element

- ☐ Swing with open-end spanner to slacken poly V-belt ⇒ page 17

7 - Alternator

8 - Bracket for ancillaries

9 - Bolt

- ☐ Observe tightening sequence ⇒ page 17 .
- ☐ 45 Nm

10 - Banjo bolt

- ☐ 30 Nm

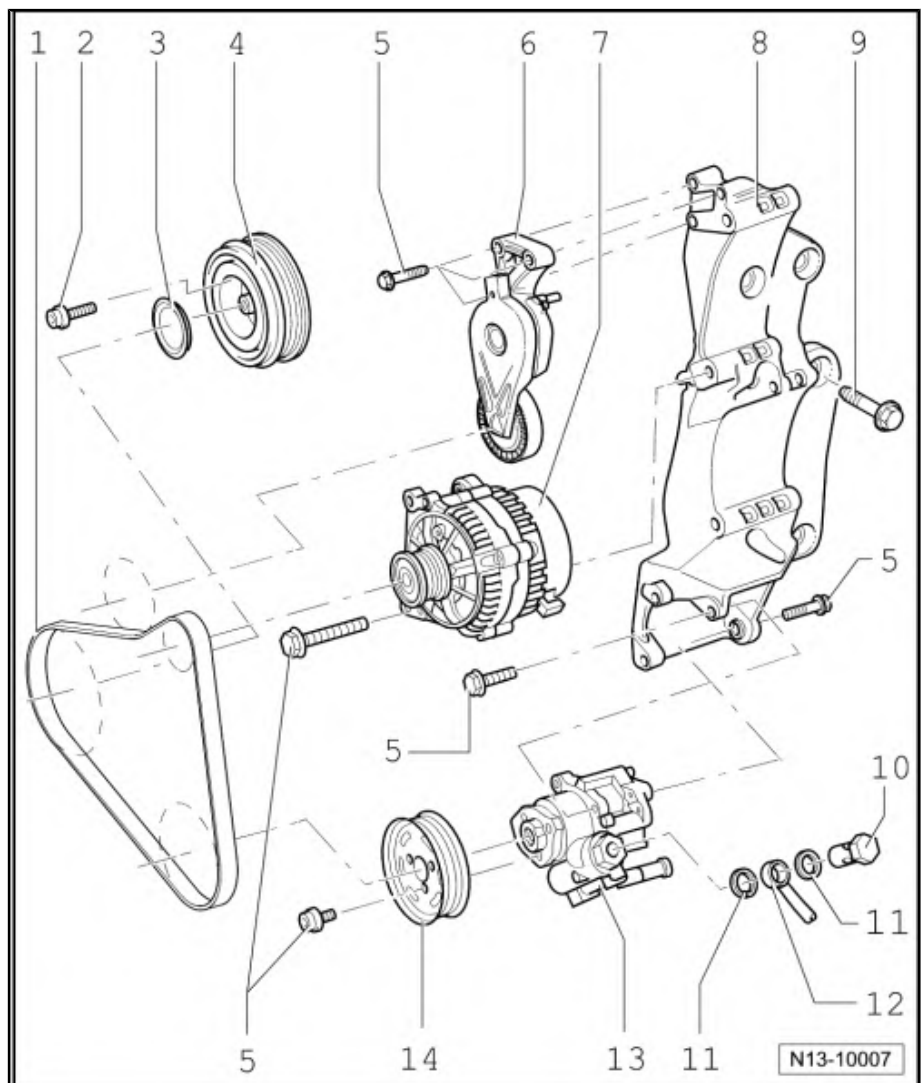
11 - Seal

- ☐ Renew after removing.

12 - Pressure line

13 - Vane pump

- ☐ Removing and installing ⇒ Running gear, axles and steering; Rep. gr. 48 ; Steering





14 - Belt pulley

1.2 Assembly overview - crankcase

1 - Cylinder block

- ❑ Removing and installing crankshaft ➔ [page 36](#).
- ❑ Dismantling and assembling pistons and con-rods ➔ [page 39](#).

2 - Bracket

3 - Gasket

- ❑ Renew after removing.

4 - Bolt

- ❑ 15 Nm

5 - Oil filter bracket

6 - Bolt

- ❑ Renew after removing.
- ❑ First fit upper left and lower right bolts and then tighten all 4 bolts in diagonal sequence.
- ❑ 15 Nm + 90°

7 - Bolt

- ❑ 15 Nm

8 - Engine speed sender - G28-

- ❑ Removing and installing, engine codes BRR and BRS ➔ [page 170](#).

9 - Connection

- ❑ For thermostat.

10 - Bolt

- ❑ 15 Nm

11 - O-ring

- ❑ Renew after removing.

12 - Thermostat

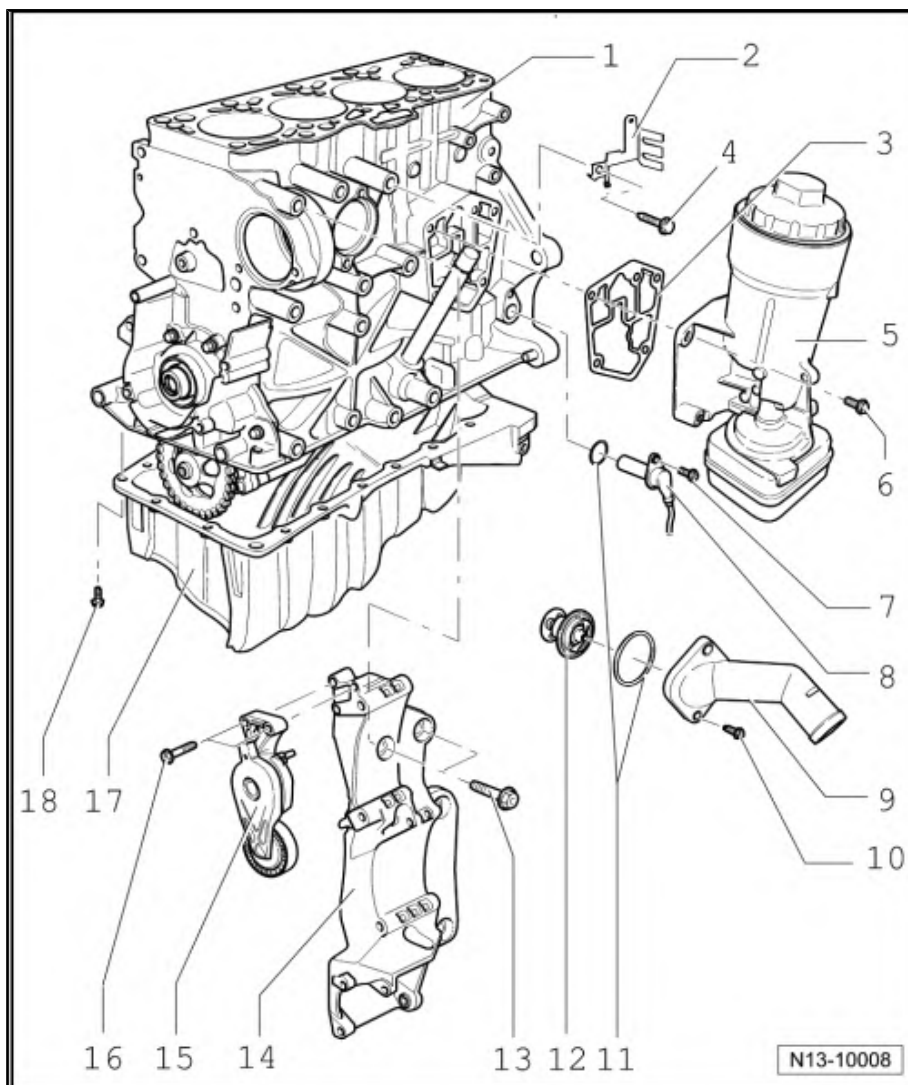
- ❑ Checking: heat thermostat in water.
- ❑ Opening begins at approx. 85 °C.
- ❑ Ends at approx. 105 °C.
- ❑ Opening lift at least 7 mm.
- ❑ Note installation position ➔ [page 116](#).
- ❑ Removing and installing ➔ [page 116](#).

13 - Bolt

- ❑ Observe tightening sequence ➔ [page 17](#).
- ❑ 45 Nm

14 - Bracket

- ❑ Observe tightening sequence ➔ [page 17](#).





15 - Poly V-belt tensioning element

16 - Bolt

- 25 Nm

17 - Oil sump

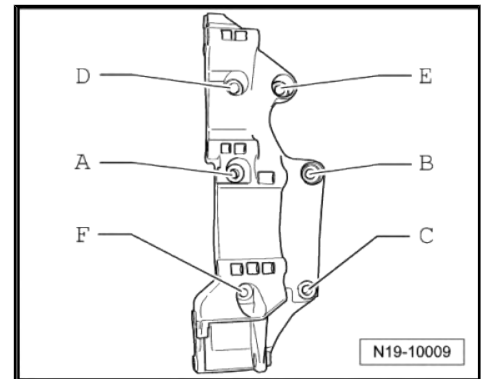
- Clean sealing surface before fitting.
- With Silicone sealant → Electronic Parts Catalogue (ETKA)

18 - Bolt

- 15 Nm

Sequence for tightening ancillary bracket to cylinder block

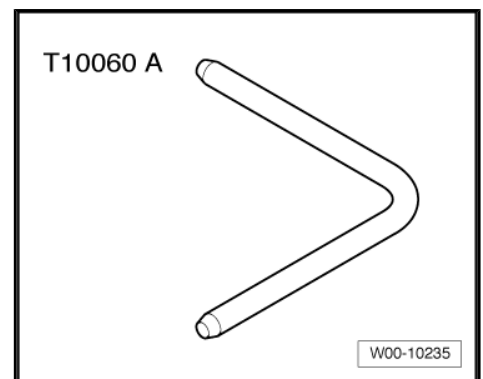
- Place ancillary bracket on cylinder block (observe dowel sleeve between ancillary bracket and cylinder block).
- Tighten ancillary bracket as shown in following tightening sequence:
 - 1 - Tighten bolt -A- to 45 Nm
 - 2 - Tighten bolt -B- to 45 Nm
 - 3 - Tighten bolt -C- to 45 Nm
 - 4 - Tighten bolt -D- to 45 Nm
 - 5 - Tighten bolt -E- to 45 Nm
 - 6 - Tighten bolt -F- to 45 Nm



1.3 Removing and installing poly V-belt

Special tools and workshop equipment required

- ◆ Locking pin - T10060 A-

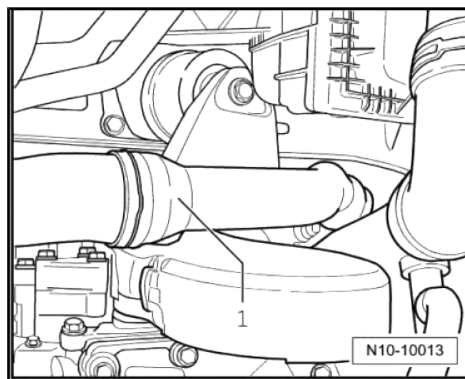


Removing

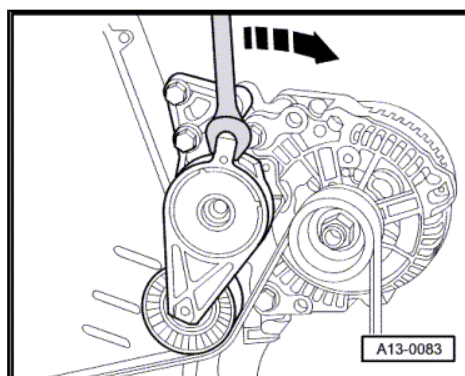
- Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Body, front; Noise insulation .



- Remove connecting pipe -1- with connecting hoses between charge air cooler and turbocharger.



- Mark direction of rotation of poly V-belt.
- To slacken poly V-belt, swivel tensioning element in direction of arrow (using, for example, 16 mm open-end spanner).



- Lock tensioning element using locking pin - T10060 A- .
- Remove poly V-belt.

Installing

Installation is carried out in the reverse order; note the following:



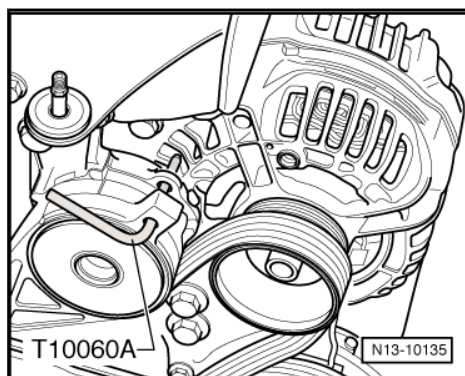
Note

- ◆ *Before installing poly V-belt, ensure that all sub-assemblies (alternator, air conditioner compressor and vane pump) are securely mounted.*
- ◆ *When fitting poly V-belt, check direction of belt rotation and proper seating of belt in belt pulleys.*
- ◆ *For vehicles without air conditioning, put poly V-belt over alternator last.*
- ◆ *For vehicles with air conditioning, put poly V-belt over air conditioner compressor last.*

- Remove locking pin - T10060 A- .

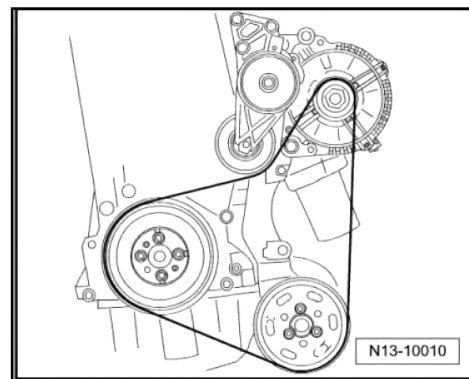
After completing repair, always:

- Start engine and check that belt runs properly.





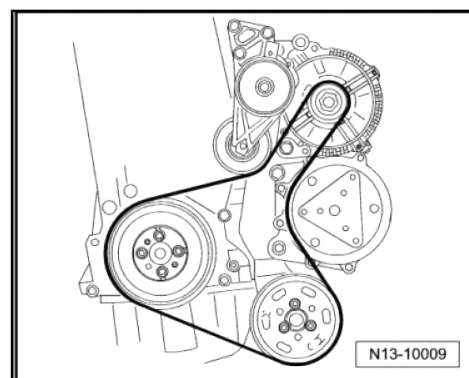
Belt drive without air conditioner compressor



Belt drive with air conditioner compressor

Specified torques

- ◆ ⇒ [“2.1 Assembly overview - charge air system”, page 139](#)
- ◆ Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 50 ; Assembly overview - noise insulation

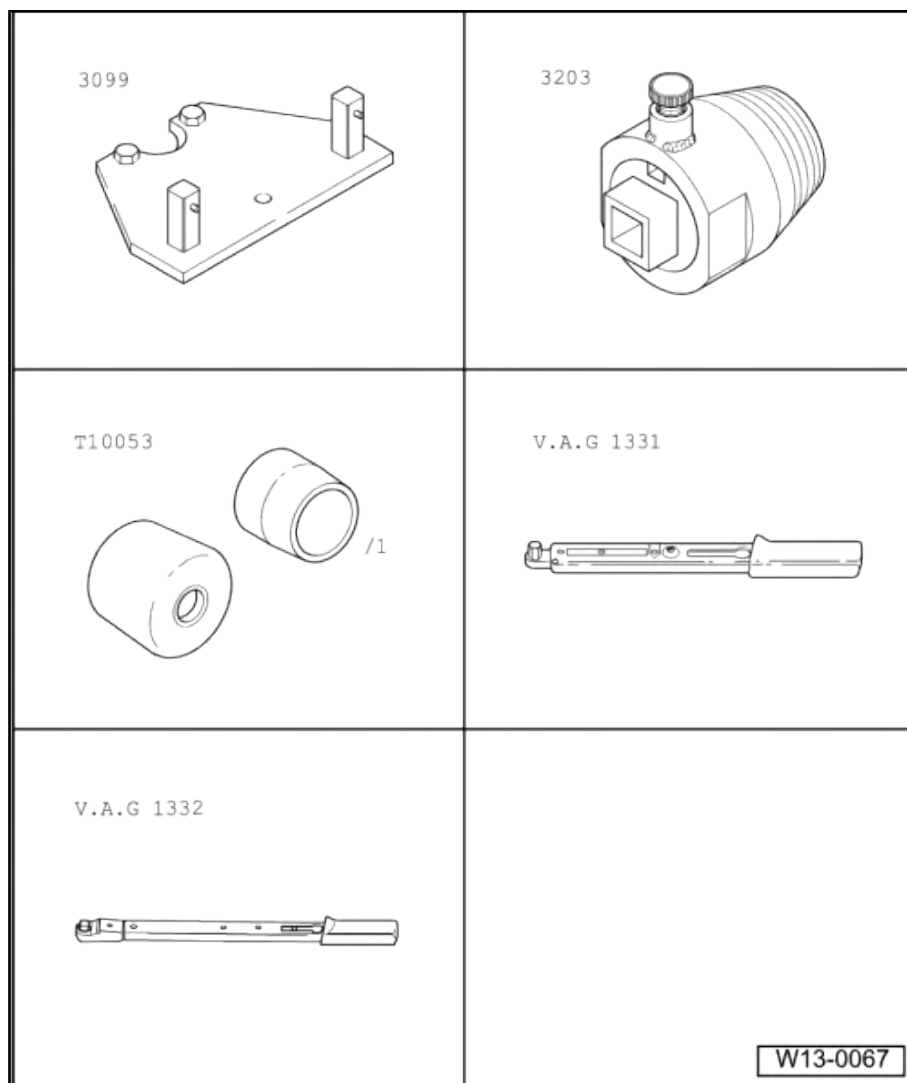




1.4 Renewing crankshaft oil seal - belt pulley end

Special tools and workshop equipment required

- ◆ Counterhold tool - 3099-
- ◆ Oil seal extractor - 3203-
- ◆ Assembly tool - T10053-
- ◆ Torque wrench - V.A.G 1331-
- ◆ Torque wrench - V.A.G 1332-



Removing:

- Removing toothed belt (for vehicles ► 12.05) ⇒ [page 65](#) .
- Removing toothed belt, (for vehicles 01.06 ►) ⇒ [page 73](#) .



- Remove crankshaft toothed belt pulley. To do this, lock toothed belt pulley using counterhold - 3099- .

i Note

- ◆ *When bolting on counterhold, remove one securing bolt from sump.*
- ◆ *When bolting on counterhold, place two washers between toothed belt pulley and counterhold.*
- To guide oil seal extractor - 3203- , screw centre bolt into crankshaft by hand to stop.
- Unscrew inner part of oil seal extractor - 3203- 2 turns (approx. 3 mm) from the outer part and lock in position with the knurled screw.
- Lubricate threaded head of oil seal extractor.
- Position oil seal extractor - 3203- and screw forcibly as far as possible into oil seal.
- Loosen knurled screw and turn inner part against crankshaft until the oil seal is pulled out.

Installing

Installation is carried out in the reverse order; note the following:

i Note

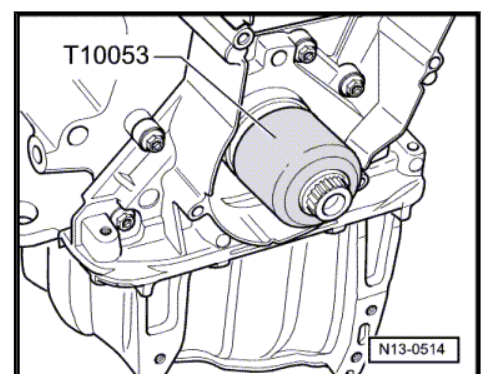
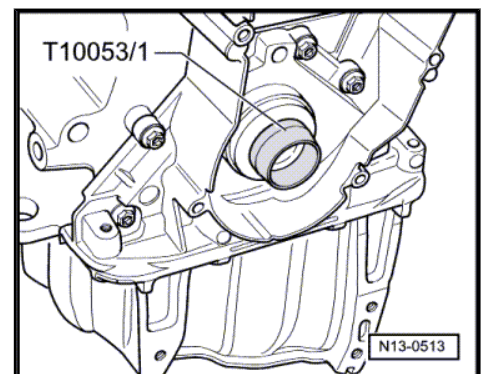
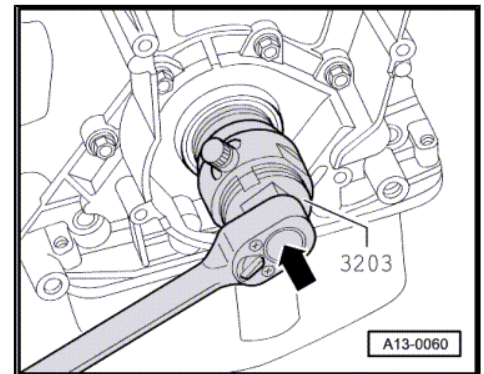
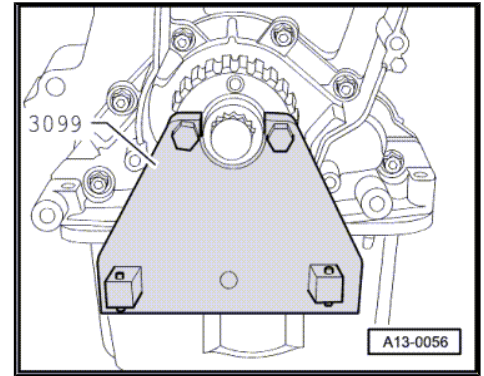
The oil seal sealing lip must not be additionally oiled or greased.

- Remove oil residues from crankshaft journal with a clean cloth.
- Fit guide sleeve - T10053/1- onto crankshaft journal.
- Slide seal over guide sleeve - T10053/1- onto crankshaft journal.

- Using press sleeve - T10053- , press in onto stop with central bolt.
- Installing, tensioning toothed belt (for vehicles ► 12.05)
⇒ [page 65](#) .
- Installing, tensioning toothed belt (for vehicles 01.06 ►)
⇒ [page 73](#) .

Specified torques

- ◆ ⇒ [“2.1 Assembly overview - toothed belt drive”, page 64](#)
- ◆ ⇒ [“2.1 Assembly overview - assembly mountings”, page 14](#)

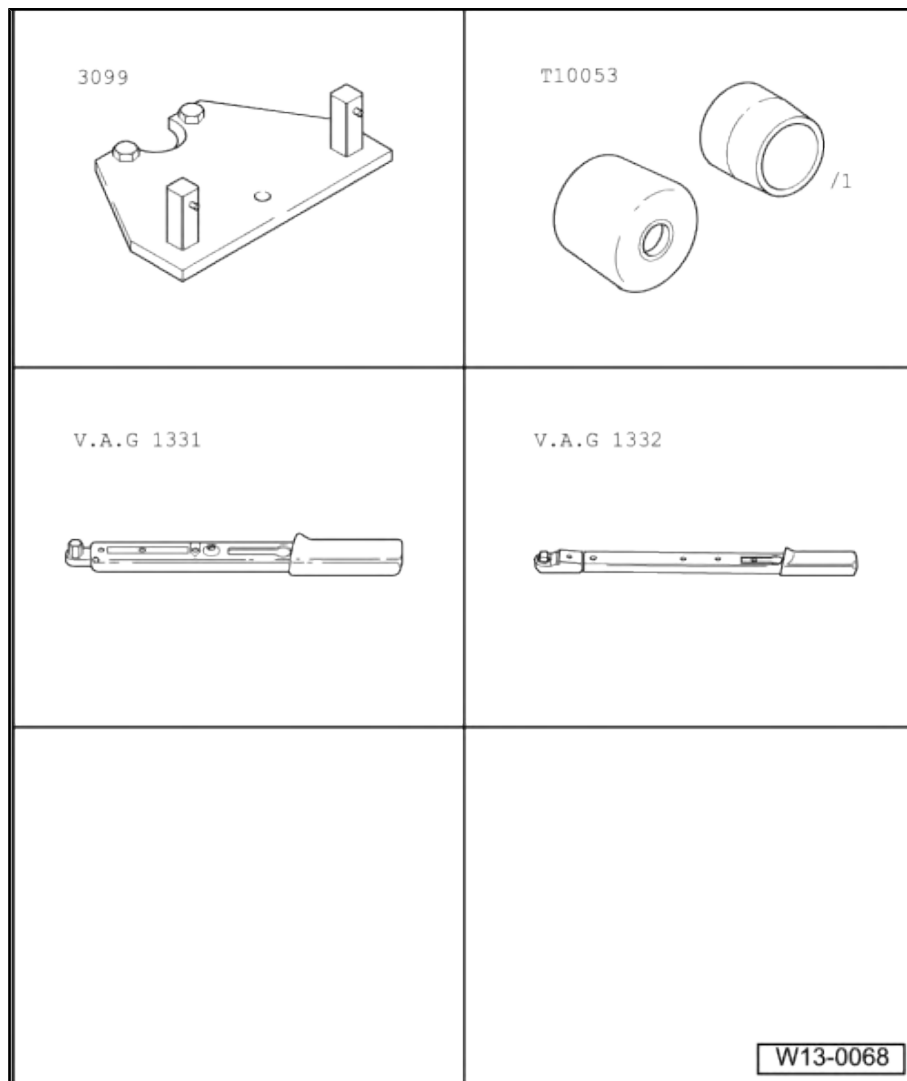




1.5 Removing and installing sealing flange on pulley end

Special tools and workshop equipment required

- ◆ Counterhold tool - 3099-
- ◆ Assembly tool - T10053-
- ◆ Torque wrench - V.A.G 1331-
- ◆ Torque wrench - V.A.G 1332-
- ◆ Silicone sealant ⇒ Electronic Parts Catalogue (ET-KA)
- ◆ Flat scraper
- ◆ Hand drill with plastic brush attachment



Removing

- Removing toothed belt, (for vehicles ► 12.05) ⇒ [page 65](#) .
- Removing toothed belt, (for vehicles 01.06 ►) ⇒ [page 73](#) .



- Remove crankshaft toothed belt pulley. To do this, lock toothed belt pulley using counterhold - 3099- .

i Note

- ◆ *To fit the counterhold it is possible that 1 sump securing screw must be removed.*
- ◆ *When bolting on counterhold, place two washers between toothed belt pulley and counterhold.*

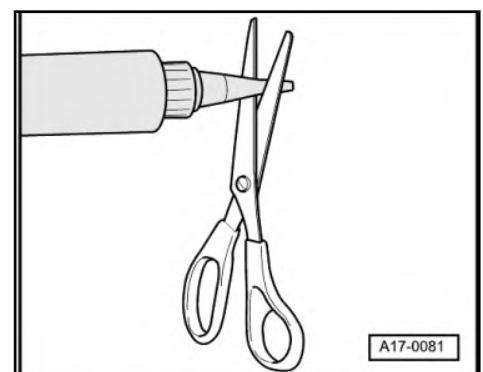
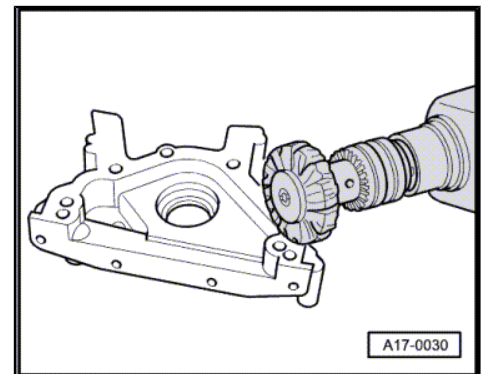
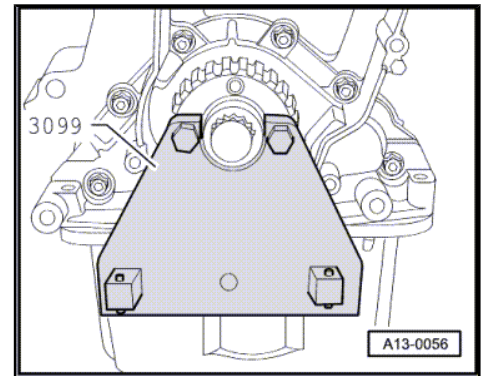
- Drain off engine oil.
- Remove sump ⇒ [page 96](#) .
- Unbolt front sealing flange.
- Remove sealing flange; if necessary, loosen using light blows with a rubber headed hammer.
- Remove sealant residues from cylinder block with a flat scraper.
- Remove residual sealant on sealing flange using a rotating plastic brush (wear eye protection).
- Clean sealing surfaces. They must be free of oil and grease.

Installing

Installation is carried out in the reverse order; note the following:

i Note

- ◆ *Observe use-by-date of sealant.*
- ◆ *The sealing flange must be installed within 5 minutes of applying the silicone sealant.*
- ◆ *Sealant bead must not be wider than 2...3 mm because excess sealant can otherwise enter sump and block strainer in oil pump suction line or drip onto crankshaft oil seal.*
- ◆ *Before applying sealant bead, cover the sealing surface of the sealing ring with a clean cloth.*
- Cut off nozzle of tube at front marking (Ø of nozzle approx. 3 mm).





- Apply silicone sealant bead as shown to clean sealing surface of sealing flange.
- Fit sealing flange immediately and lightly tighten all bolts.



Note

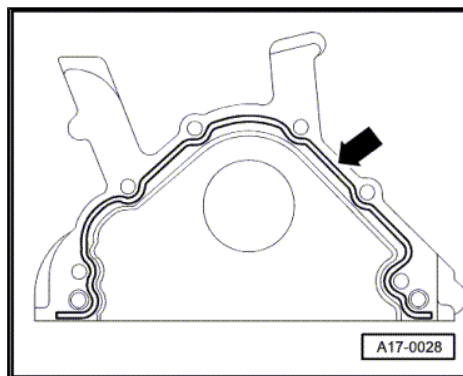
- ◆ *When fitting sealing flange with oil seal installed use guide sleeve - T10053/1-.*
- ◆ *Sealing compound must dry for approx. 30 minutes after installation. Only then fill with engine oil.*
- Tighten sealing flange securing bolts diagonally and alternately.
- Install sump ⇒ [page 96](#).

Install toothed belt and adjust valve timing (for vehicles ► 12.05)
⇒ [page 65](#).

Install toothed belt and adjust valve timing (for vehicles 01.06 ►)
⇒ [page 73](#).

Specified torques

- ◆ ⇒ [“2.1 Assembly overview - toothed belt drive”, page 64](#)
- ◆ ⇒ [“2.1 Assembly overview - assembly mountings”, page 14](#)
- ◆ ⇒ [“1.1 Assembly overview - sump and oil pump”, page 95](#)







2 Cylinder block, gearbox end

⇒ ["2.1 Assembly overview - cylinder block, gearbox end", page 26](#)

⇒ ["2.2 Removing and installing sealing flange on gearbox side", page 27](#)

⇒ ["2.2.1 Pressing out sealing flange with sender wheel", page 28](#)

⇒ ["2.2.2 Pressing in sealing flange with sender wheel", page 29](#)

⇒ ["2.2.3 A - Fit seal with sender wheel on assembly tool T10134", page 30](#)

⇒ ["2.2.4 B - Fit assembly tool T10134 with sealing flange on crankshaft flange", page 31](#)

⇒ ["2.2.5 C - Bolting assembly tool T10134 onto crankshaft flange", page 32](#)

⇒ ["2.2.6 D - Pressing sender wheel onto crankshaft flange using assembly tool T10134", page 33](#)

⇒ ["2.2.7 E - Checking sender wheel installation position on crankshaft", page 33](#)

⇒ ["2.2.8 F - Re-pressing sender wheel", page 34](#)

2.1 Assembly overview - cylinder block, gearbox end

1 - Seal

- ☐ Do not additionally oil or grease the oil seal sealing lip.
- ☐ Before installing, remove oil residue from crankshaft journal using a clean cloth.
- ☐ Renew. ⇒ [page 20](#).

2 - Sealing flange

- ☐ Must seat on dowel sleeves.
- ☐ Insert with silicone sealant ⇒ Electronic Parts Catalogue (ETKA).
- ☐ Removing and installing ⇒ [page 22](#).

3 - Cylinder block

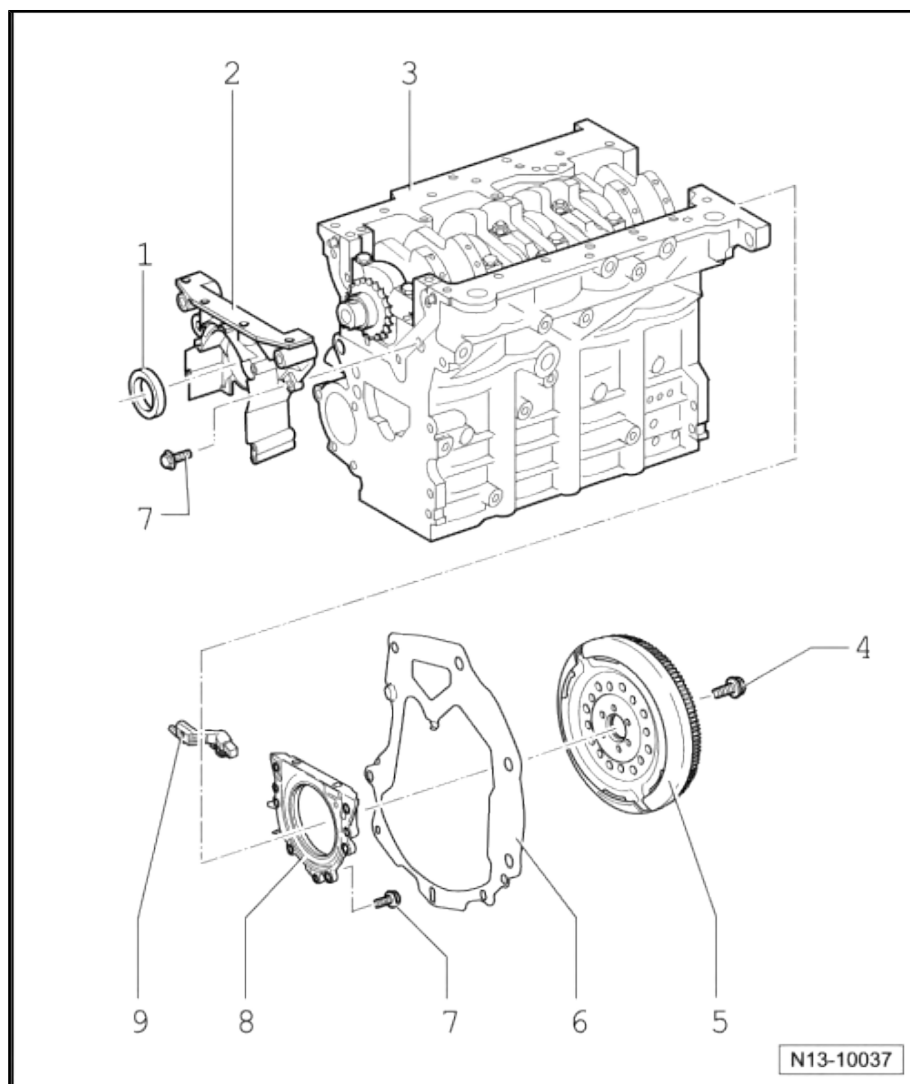
- ☐ Removing and installing crankshaft ⇒ [page 36](#).
- ☐ Dismantling and assembling pistons and con-rods ⇒ [page 39](#).

4 - Bolt

- ☐ Renew after removing.
- ☐ 60 Nm + 90°

5 - Flywheel

- ☐ When removing and installing, lock with counterhold - T10044- and





sleeve - T10044/1- .

6 - Intermediate plate

- ☐ Must seat on dowel sleeves.
- ☐ Do not damage or bend when assembling.

7 - Bolt

- ☐ 15 Nm

8 - Sealing flange with oil seal

Engine codes BRR and BRS:

- ☐ Renew complete with oil seal and sender wheel only.
- ☐ Renew. ⇒ [page 27](#) .

Engine codes AXB and AXC:

- ☐ Renew complete only.
- ☐ Do not additionally oil or grease the oil seal sealing lip.
- ☐ Before installing, remove oil residue from crankshaft journal using a clean cloth.
- ☐ Use support sleeve supplied when installing.
- ☐ Only remove supporting sleeve after sealing flange has been slid onto crankshaft journal.

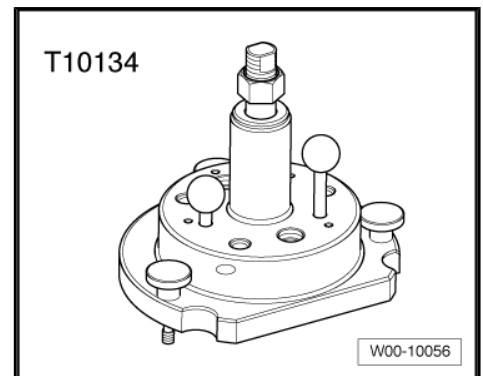
9 - Engine speed sender - G28-

- ☐ In crankcase for engine codes AXB and AXC ⇒ [Item 8 \(page 16\)](#) .
- ☐ Removing and installing, engine codes BRR and BRS ⇒ [page 170](#) .
- ☐ 5 Nm

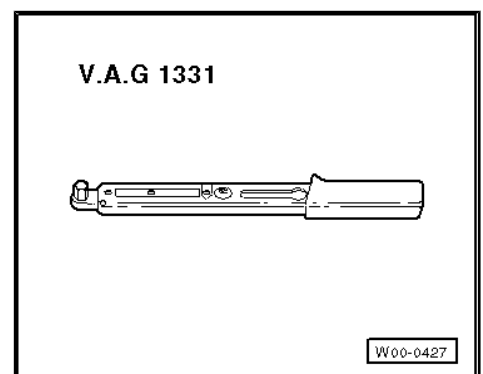
2.2 Removing and installing sealing flange on gearbox side

Special tools and workshop equipment required

- ◆ Assembly tool - T10134-

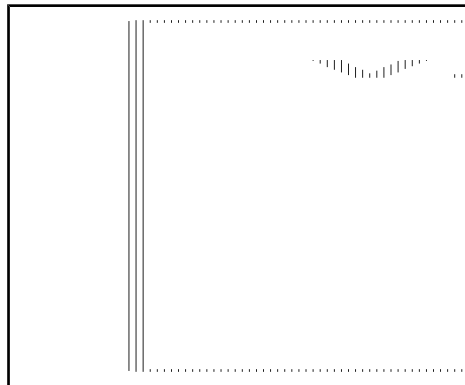


- ◆ Torque wrench - V.A.G 1331-





- ◆ Socket - V.A.G 1332/11-



Not illustrated:

- ◆ Vernier gauge
- ◆ 3 hexagon bolts M6 x 35 mm
- ◆ 2 hexagon bolts M7 x 35 mm

2.2.1 Pressing out sealing flange with sender wheel



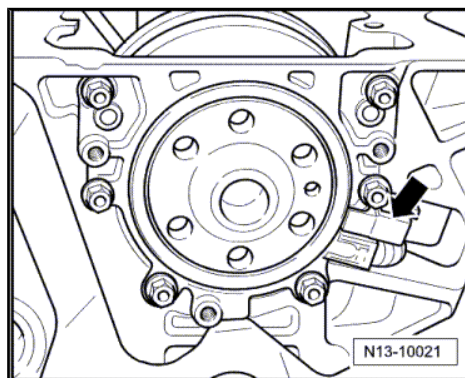
Note

- ◆ *For the sake of clarity, the work is performed with the engine removed.*
- ◆ *The procedure is identical whether the engine is installed or removed.*
- Remove flywheel.
- Remove intermediate plate.
- Set engine to TDC for No. 1 cylinder, Removing, installing and tensioning toothed belt (for vehicles ► 12.05) ⇒ [page 65](#) .
- Set engine to TDC for No. 1 cylinder, Removing, installing and tensioning toothed belt (for vehicles 01.06 ►) ⇒ [page 73](#) .
- Remove sump ⇒ [page 96](#) .
- Remove engine speed sender - G28- -arrow- using a commercially available ball-ended hex key socket.
- Unscrew securing bolts of sealing flange.



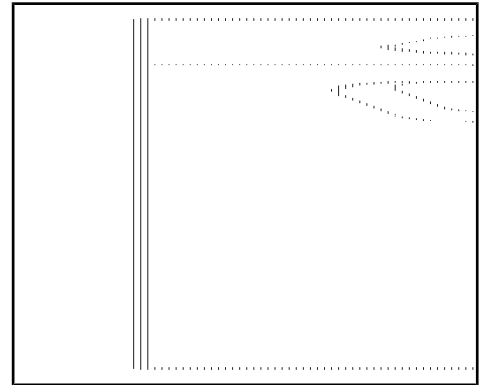
Note

Sealing flange and sender wheel are pressed off the crankshaft together using 3 M6 x 35 mm bolts.





- Screw 3 M6 x 35 mm bolts into threaded holes of sealing flange -arrows-.
- Screw bolts alternately (max. $\frac{1}{2}$ turn (180°) for each bolt) into sealing flange and press sealing flange off crankshaft together with sender wheel.



2.2.2 Pressing in sealing flange with sender wheel

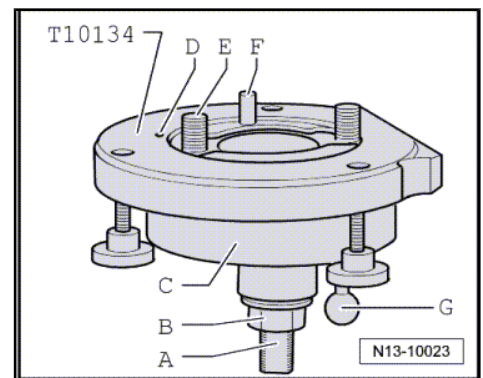


Note

- ◆ *The sealing flange with a PTFE seal is equipped with a sealing lip support ring. This support ring serves as a fitting sleeve and must not be removed prior to installation.*
- ◆ *Sealing flange and sender wheel must not be separated or turned after removal from packaging.*
- ◆ *The sender wheel is held in its installation position on the assembly device - T10134- by a locating pin.*
- ◆ *Sealing flange and oil seal form one unit and must only be renewed together with the sender wheel.*
- ◆ *The assembly device - T10134- is held in its position relative to the crankshaft by a guide pin inserted into a hole in the crankshaft.*

Assembly tool - T10134-

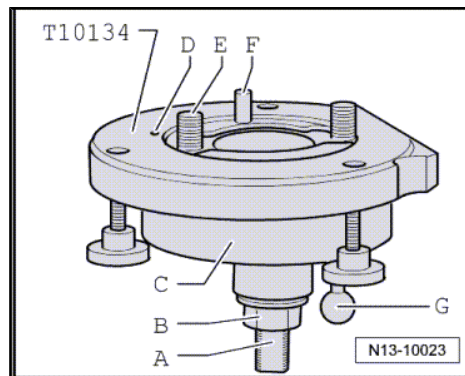
- A - Clamping surface
- B - Hexagon nut
- C - Assembly housing
- D - Locating pin
- E - Hexagon socket head bolt
- F - Guide pin for diesel engines (black knob)
- G - Guide pin for petrol engines (red knob)





2.2.3 A - Fit seal with sender wheel on assembly tool - T10134-

- Screw on hexagon nut -B- until just before it touches clamping surface -A- of threaded spindle.

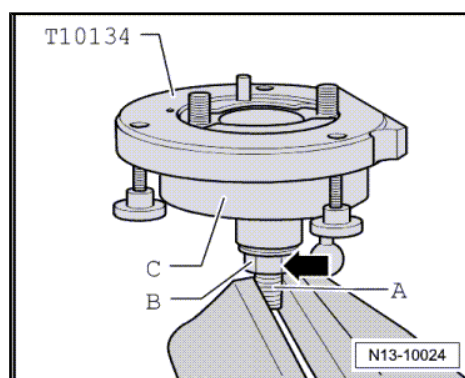


- Clamp assembly device - T10134- in a vice on clamping surface -A- of threaded spindle.
- Press the assembly housing -C- downwards until it lies on hexagon nut -B-, -arrow-.



Note

Inner part of assembly tool and assembly housing must be at same height.

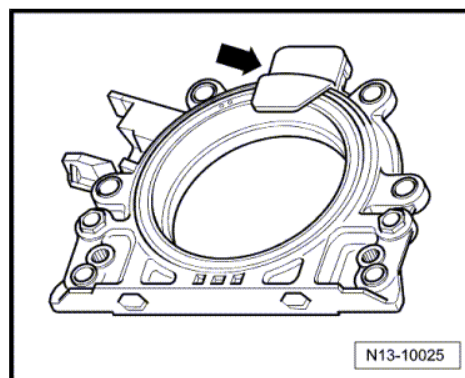


- Remove securing clip -arrow- from new sealing flange.

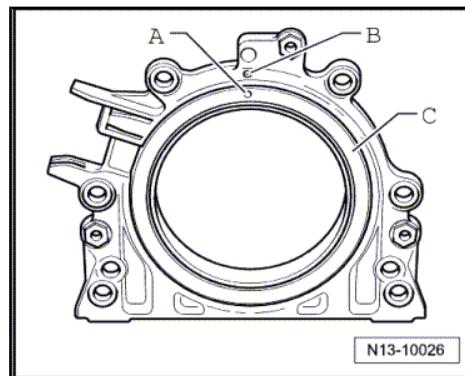


Note

The sender wheel must not be taken out of the sealing flange or twisted.

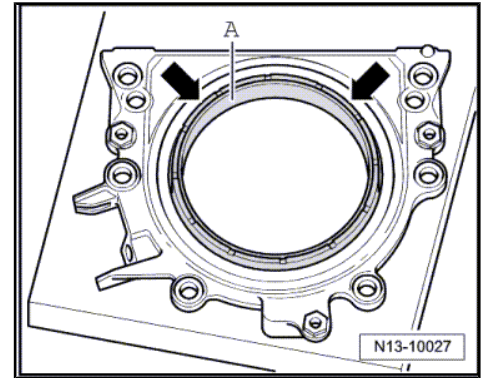


- Locating hole -A- on sender wheel -C- must align with marking -B- on sealing flange.
- Place sealing flange with front side facing down on a clean level surface.

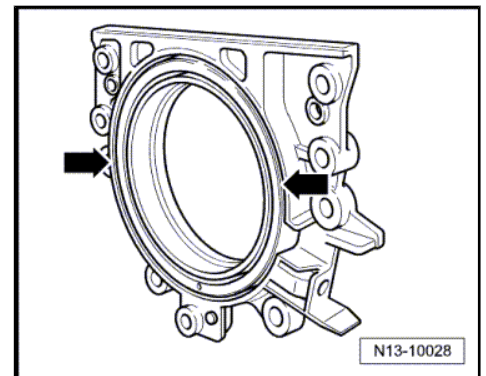




- Push sealing lip support ring -A- downwards in direction of arrow until it lies on flat surface.



- Upper edge of sender wheel and front edge of sealing flange must align -arrows-.

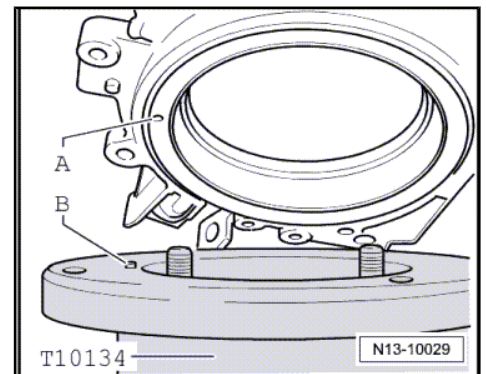


- Place sealing flange with front side facing downwards onto assembly tool - T10134- so that locating pin -B- can be inserted in sender wheel hole -A-.



Note

Ensure sealing flange lies flat on assembly tool.

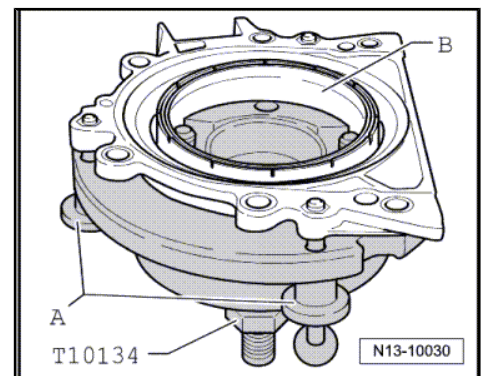


- Push sealing flange and support ring for sealing lip -B- against surface of assembly tool - T10134- whilst tightening the 3 knurled screws -A- so that locating pin cannot slide out of sender wheel hole.



Note

When installing sealing flange, ensure that sender wheel remains fixed in assembly device.

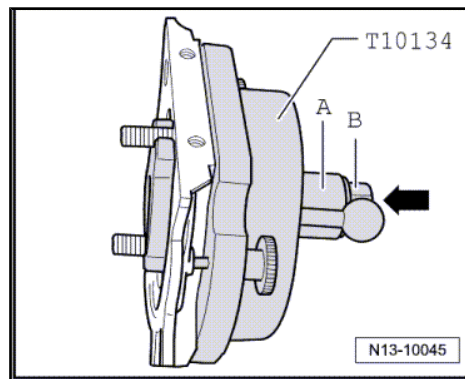


2.2.4 B - Fit assembly tool - T10134- with sealing flange on crankshaft flange

- Crankshaft flange must be free of oil and grease.
- Engine positioned at TDC No. 1 cylinder.



- Screw hexagon nut -B- on until it reaches end of threaded spindle.
- Press threaded spindle of assembly tool - T10134- in direction of arrow, until hexagon nut -B- lies against assembly housing -A-.
- Align flat side of assembly housing to crankcase's sealing surface on the oil sump side.

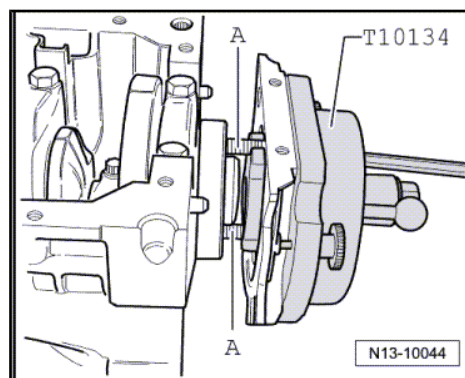


- Secure assembly tool - T10134- to crankshaft flange with hexagon socket head bolts -A-.

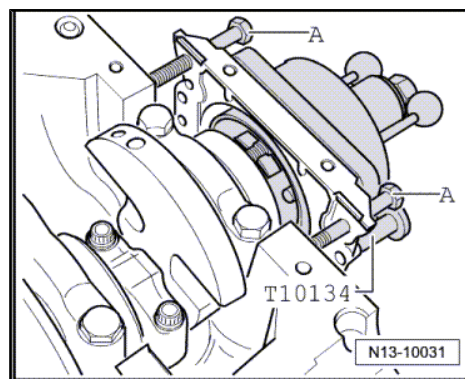


Note

Screw hexagon socket head bolts -A- into crankshaft flange (approx. 5 full turns).



- To guide sealing flange into cylinder block, screw in 2 M7 × 35 mm bolts -A-.



2.2.5 C - Bolting assembly tool - T10134- onto crankshaft flange

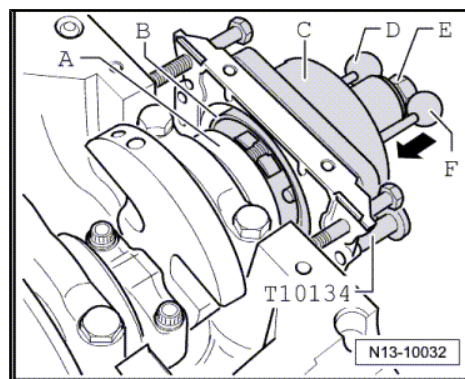
- Push assembly housing -C- by hand in direction of arrow until sealing lip support ring -B- touches crankshaft flange -A-.
- Push guide pin for diesel engines (black knob) -D- into hole in crankshaft. This ensures that the sender wheel reaches its final installation position.



Note

The guide pin for petrol engines (red knob) -F- must not be inserted in threaded hole of crankshaft.

- Tighten the two hexagon socket head bolts of the assembly tool hand-tight.
- Screw hexagon nut -E- onto threaded spindle by hand until it lies against assembly housing -C-.





2.2.6 D - Pressing sender wheel onto crankshaft flange using assembly tool - T10134-

- Tighten hexagon nut of assembly tool - T10134- using torque wrench - V.A.G 1331- and 24 mm flared ring spanner tool insert - V.A.G 1332/11- .

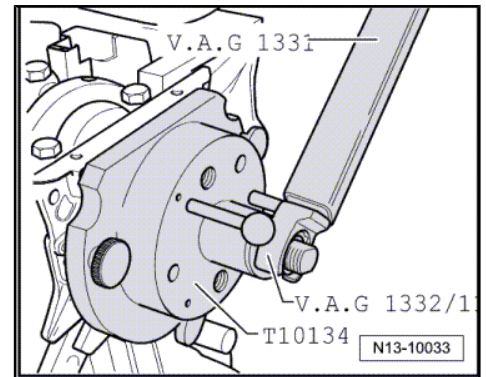
Specified torque

Component	Specified torque
Hexagon nut of assembly tool - T10134-	35 Nm



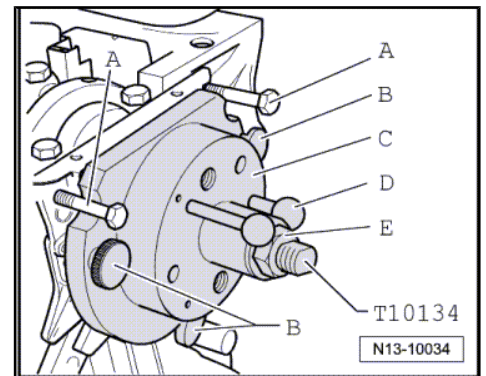
Note

After hexagon nut is tightened a small air gap must still be present between cylinder block and sealing flange.

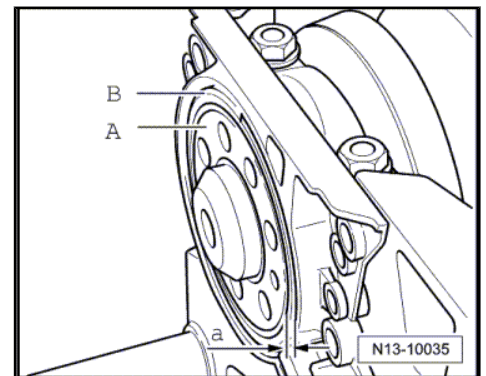


2.2.7 E - Checking sender wheel installation position on crankshaft

- Screw on the hexagon nut -E- until it reaches the end of the threaded spindle.
- Unscrew 2 bolts -A- from cylinder block.
- Unscrew the three knurled screws -B- out of sealing flange.
- Remove assembly tool - T10134- .
- Remove sealing lip support ring.



- The sender wheel is in the correct installation position on the crankshaft if a gap -a- = 0.5 mm exists between crankshaft flange -A- and sender wheel -B-.





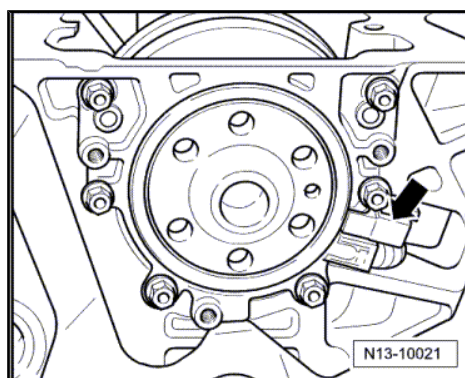
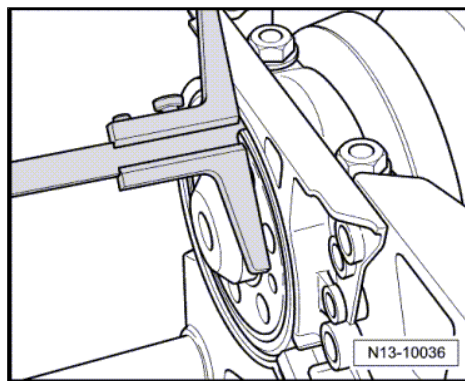
- Place caliper gauge on crankshaft flange.
- Measured distance -a- between crankshaft flange and sender wheel.

If dimension -a- is too small:

- Re-press sender wheel ➔ [page 34](#) .

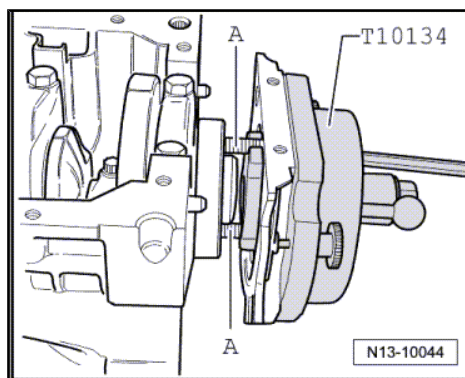
If dimension -a- is achieved:

- Tighten new sealing flange securing bolts diagonally and alternately.
- Install engine speed sender - G28- -arrow- and tighten securing bolt.
- Install sump ➔ [page 96](#) .
- Install intermediate plate.
- Install flywheel with new bolts.

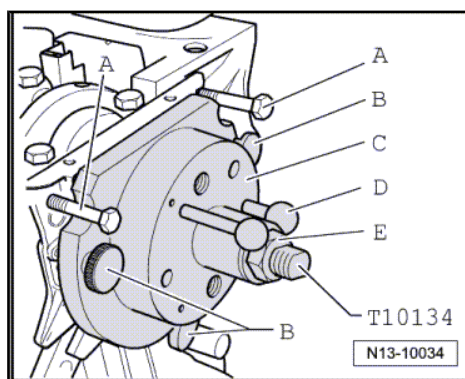


2.2.8 F - Re-pressing sender wheel

- Secure assembly tool - T10134- to crankshaft flange with hexagon socket head bolts -A-.
- Tighten the two hexagon socket head bolts hand-tight.
- Push the assembly tool - T10134- against the sealing flange by hand.



- Screw hexagon nut -E- onto threaded spindle by hand until it lies against assembly housing -C-.





- Tighten hexagon nut of assembly tool - T10134- using torque wrench - V.A.G 1331- and 24 mm flared ring spanner tool insert - V.A.G 1332/11- .

Specified torque

Component	Specified torque
Hexagon nut of assembly tool - T10134-	40 Nm

- Check the sender wheel installation position on crankshaft again ⇒ [page 33](#)

If dimension -a- is too small again:

- Tighten hexagon nut of assembly tool - T10134- .

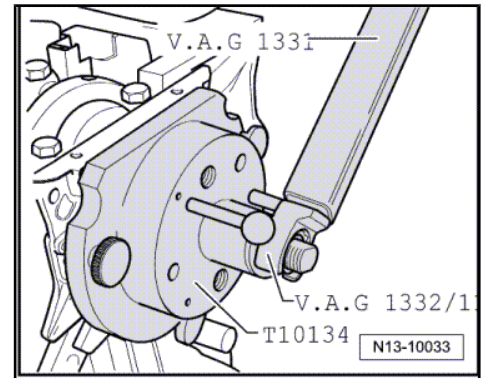
Specified torque

Component	Specified torque
Hexagon nut of assembly tool - T10134-	45 Nm

- Check the sender wheel installation position on crankshaft again ⇒ [page 33](#)

Specified torques

- ◆ ⇒ [“2.1 Assembly overview - cylinder block, gearbox end”, page 26](#)
- ◆ ⇒ [“1.1 Assembly overview - sump and oil pump”, page 95](#)
- ◆





3 Crankshaft

⇒ "3.1 Assembly overview - crankshaft", page 36

⇒ "3.2 Removing and installing sender wheel", page 37

⇒ "3.3 Crankshaft dimensions", page 38

3.1 Assembly overview - crankshaft



Note

If large quantities of swarf or metal particles (caused, for example, by partial seizure of the crankshaft or conrod bearings) are found in the engine oil when performing repairs, clean the oil passages thoroughly and renew the engine oil cooler in order to prevent subsequent damage.

1 - Bearing shells 1, 2, 4 and 5

- ☐ For bearing cap without oil groove.
- ☐ For cylinder block with oil groove.
- ☐ Do not interchange used bearing shells (mark).

2 - Bolt

- ☐ Renew after removing.
- ☐ To measure radial clearance, tighten to 65 Nm but not further.
- ☐ 65 Nm + 90°

3 - Bearing cap

- ☐ Bearing cap 1: belt pulley end.
- ☐ Bearing cap 3 with recesses for thrust washers.
- ☐ Bearing shell retaining lugs in cylinder block and bearing caps must align.

4 - Bearing shell 3

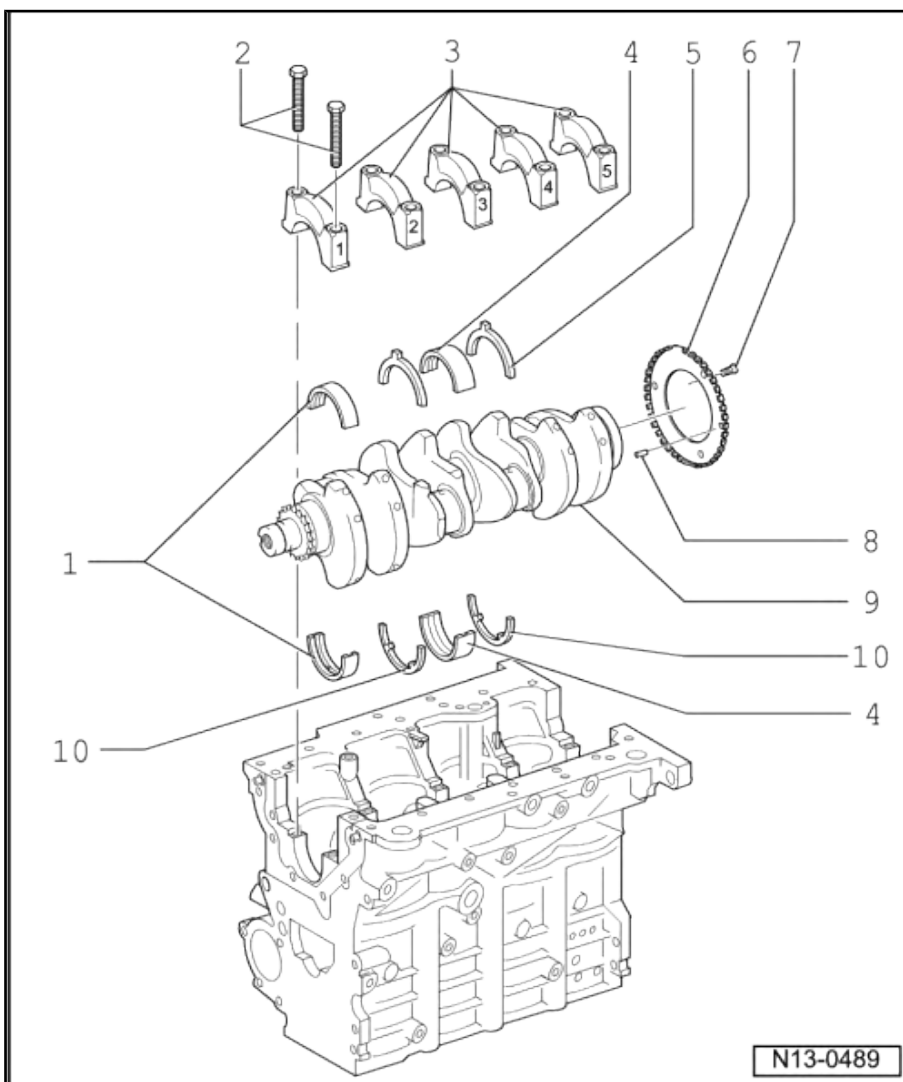
- ☐ For bearing cap without oil groove.
- ☐ For cylinder block with oil groove.

5 - Thrust washer

- ☐ For bearing cap 3.
- ☐ Note fixing arrangement.

6 - Sender wheel

- ☐ Only engine codes AXB and AXC
- ☐ For engine speed sender - G28- .
- ☐ Renew if damaged.





- ☐ Always renew sender wheel if securing bolts have been unscrewed.
- ☐ Removing and installing ⇒ [page 37](#) .

7 - Bolt

- ☐ Only engine codes AXB and AXC
- ☐ Renew after removing.
- ☐ 10 Nm + 90°

8 - Dowel pin

- ☐ Only engine codes AXB and AXC
- ☐ Check projection from crankshaft ⇒ [page 37](#)

9 - Crankshaft

- ☐ Axial clearance, new: 0.07...0.17 mm; wear limit: 0.37 mm
- ☐ Measure radial clearance with Plastigage , new: 0.03...0.08 mm; wear limit: 0.17 mm.
- ☐ Do not rotate crankshaft when checking radial clearance.
- ☐ Crankshaft dimensions ⇒ [page 38](#) .

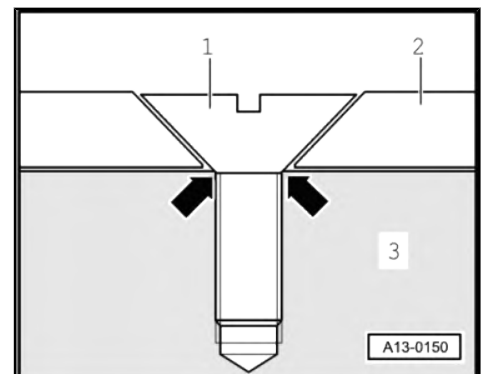
10 - Thrust washer

- ☐ For cylinder block, bearing 3.

3.2 Removing and installing sender wheel

Special tools and workshop equipment required

- ◆ Depth gauge



- Always renew sender wheel -2- each time bolts -1- are loosened.

Specified torques

- ◆ ⇒ [“3.1 Assembly overview - crankshaft”, page 36](#)



Note

The second time the bolts are tightened, the contact points in the sender wheel for the countersunk heads are deformed so far that the bolt heads seat on the crankshaft -3-, -arrows- and the sender wheel is loose under the bolts.



Checking dowel pin projection out of crankshaft

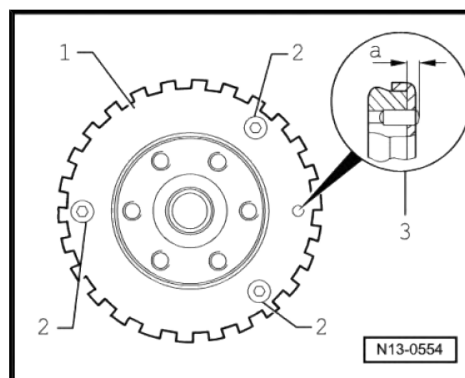
Test procedure

- Use depth gauge to check dowel pin projection -a- with sender wheel -1- removed.

1 - Sender wheel

2 - Securing bolt

3 - Projection of dowel pin -3- out of crankshaft $a = 2.5 \dots 3.0 \text{ mm}$



3.3 Crankshaft dimensions

(Dimensions in mm)

Honing dimension	Crankshaft bearing journal Ø		Conrod journal Ø	
Basic dimension	54.00	-0.022 -0.042	47.80	-0.022 -0.042



4 Pistons and conrods

⇒ ["4.1 Assembly overview - pistons and conrods", page 39](#)

⇒ ["4.2 Measuring piston projection at TDC", page 41](#)

⇒ ["4.3 Checking piston and cylinder bore", page 42](#)

⇒ ["4.4 Piston and cylinder dimensions", page 43](#)

4.1 Assembly overview - pistons and conrods

1 - Piston rings

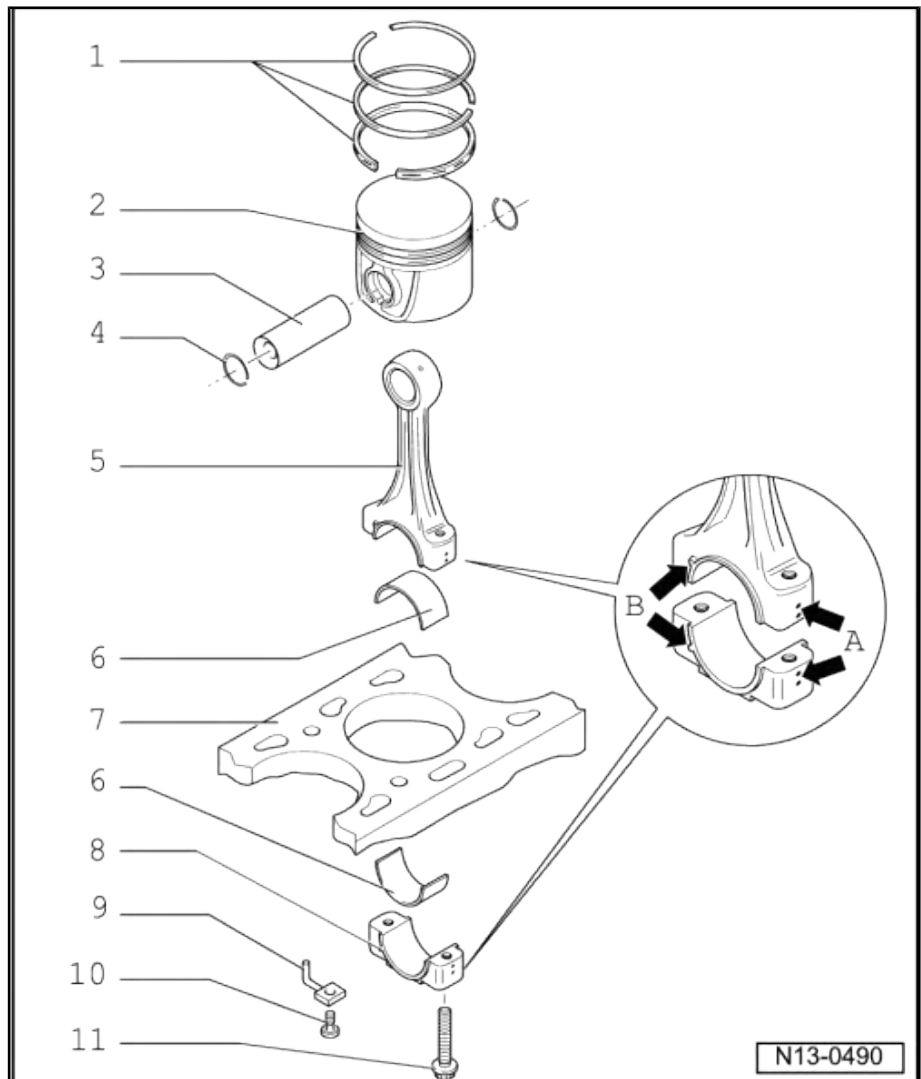
- ☐ Offset gaps by 120°.
- ☐ Use piston ring pliers to remove and install.
- ☐ "TOP" faces towards piston crown.
- ☐ Checking ring gap
⇒ [page 40](#).
- ☐ Checking ring-to-groove clearance ⇒ [page 41](#).

2 - Piston

- ☐ With combustion chamber.
- ☐ Mark installation position and cylinder number.
- ☐ Arrow on piston crown points to belt pulley end.
- ☐ Install using piston ring clamp.
- ☐ If piston skirt is cracked, renew piston.
- ☐ Installation position and allocation of piston to cylinder ⇒ [page 43](#).
- ☐ Checking piston projection at TDC
⇒ [page 41](#).

3 - Piston pin

- ☐ If difficult to remove, heat piston to 60 °C.
- ☐ Remove and install using drift - VW 222 A-.



4 - Circlip

Volkswagen Technical Site: <http://vwts.ru> <http://vwts.info>

5 - Conrod

- ☐ Mark cylinder allocation -A- with coloured pen.
- ☐ Installation position: Marking -B- faces towards pulley end.
- ☐ With industrially cracked conrod cap.

6 - Bearing shell

- ☐ Note installation position.
- ☐ Note version: Upper bearing shell (towards piston) is made of a more wear resistant material. Identification: Black line on bearing surface in area of joint.
- ☐ Do not interchange used bearing shells.
- ☐ Insert bearing shells centrally.



- ☐ Check for secure seating.
- ☐ Axial clearance, wear limit: 0.37 mm
- ☐ Check radial clearance with Plastigage; wear limit: 0.08 mm.
- ☐ Do not rotate crankshaft when checking radial clearance.

7 - Cylinder block

- ☐ Checking cylinder bores ⇒ [page 42](#) .
- ☐ Piston and cylinder dimensions ⇒ [page 43](#) .

8 - Conrod bearing cap

- ☐ Note installation position.
- ☐ Due to the cracking method used to separate the bearing cap from the conrod in manufacture, the caps only fit in one position and only on the appropriate conrod.

9 - Oil spray jet

- ☐ For piston cooling.

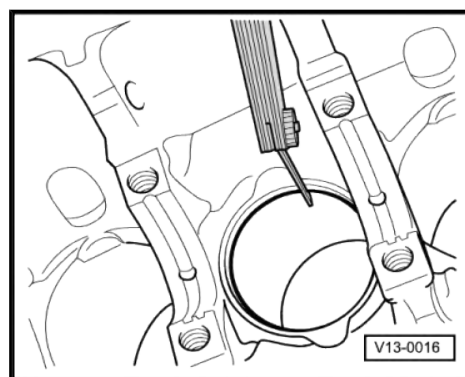
10 - Bolt

- ☐ Insert without sealant.
- ☐ 25 Nm

11 - Conrod bolt

- ☐ Renew after removing.
- ☐ Oil threads and contact surface.
- ☐ Use old bolt for measuring radial clearance.
- ☐ 30 Nm + 90°

Checking piston ring gap



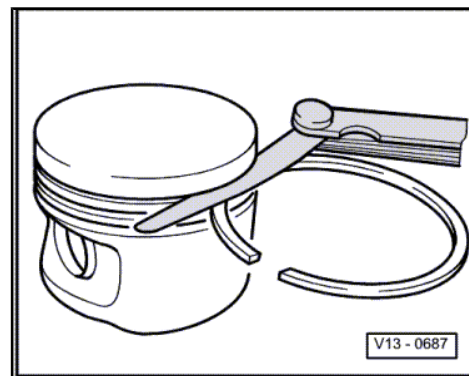
Special tools and workshop equipment required

- ◆ Feeler gauges
- Insert ring at right angles from above and push down into cylinder approx. 15 mm from bottom end of cylinder.

Piston ring dimensions in mm	New	Wear limit
1st compression ring	0.20 ... 0.40	1.0
2nd compression ring	0.20 ... 0.40	1.0
Oil scraper ring	0.25 ... 0.50	1.0



Checking ring-to-groove clearance



Special tools and workshop equipment required

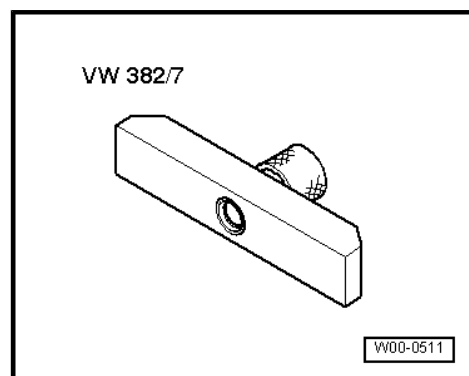
- ◆ Feeler gauges
- Clean annular groove before check.

Piston ring dimensions in mm	New	Wear limit
1st compression ring	0.06 ... 0.09	0.25
2nd compression ring	0.05 ... 0.08	0.25
Oil scraper ring	0.03 ... 0.06	0.15

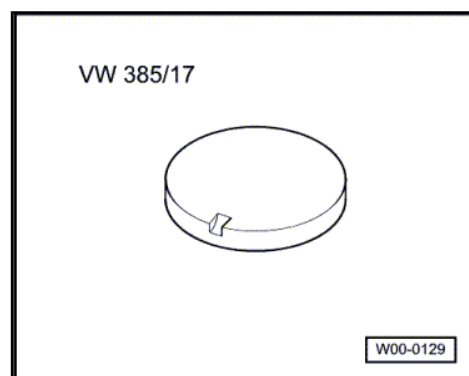
4.2 Measuring piston projection at TDC

Special tools and workshop equipment required

- ◆ Measuring tool - VW 382/7-



- ◆ Universal measuring tool - VW 385/17-



- ◆ Dial gauge



Test procedure

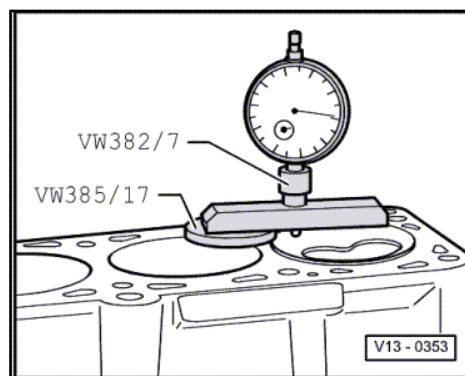
Piston projection at TDC must be measured on all pistons when installing new pistons or a short engine. Install the appropriate cylinder head gasket depending upon piston projection, according to following table:



Note

Turn engine over clockwise to measure piston projection at TDC.

Piston projection	Identification Holes/notches
0.91 mm ... 1.00 mm	1
1.01 mm ... 1.10 mm	2
1.11 mm ... 1.20 mm	3



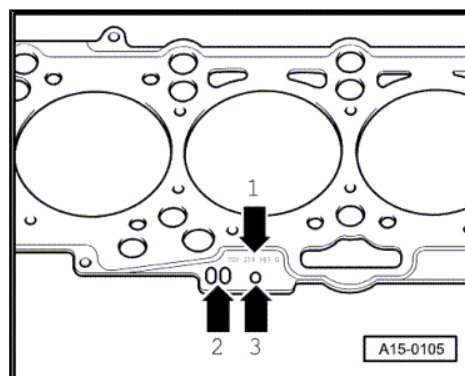
Cylinder head gasket identification

- ◆ Part no. = arrow 1
- ◆ Production control code = arrow 2 (can be disregarded)
- ◆ Holes = arrow 3



Note

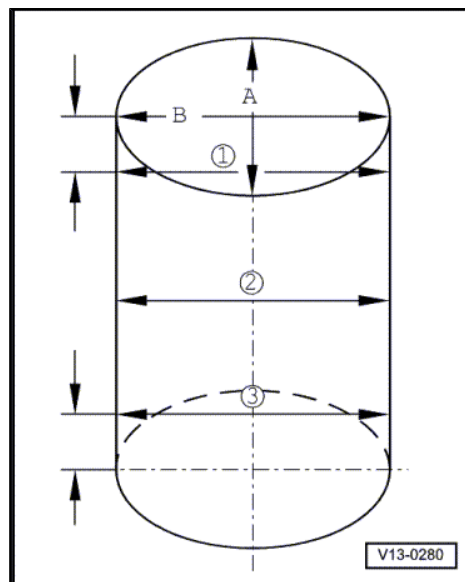
If different values are determined during the projection measurement, use the largest dimension for selecting the gasket.



4.3 Checking piston and cylinder bore

Procedure

Checking cylinder bores



Special tools and workshop equipment required

- ◆ Cylinder gauge 50...100 mm
- Take measurements at 3 positions in both lateral direction -A- and longitudinal direction -B-. Difference between actual and nominal diameter max. 0.10 mm.



Note

The cylinder bores must not be measured when the cylinder block is mounted on assembly stand, as measurements may then be incorrect.

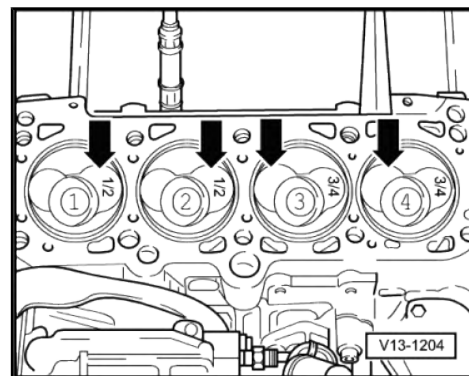
Piston installation position and allocation of piston to cylinder

Piston in cylinders 1 and 2:

Larger intake valve chamber towards flywheel -arrows-

Piston in cylinders 3 and 4:

Larger intake valve chamber towards belt pulley end -arrows-



Note

- ◆ *New piston allocation to cylinders is shown by a coloured marking on piston crown.*
- ◆ *Piston for cylinders 1 and 2: marked 1/2*
- ◆ *Piston for cylinders 3 and 4: marked 3/4*

4.4 Piston and cylinder dimensions

Honing dimension		Piston Ø	Cylinder bore Ø
Basic dimension	mm	79.47	79.51
Stage I	mm	79.72	79.76
Stage II	mm	79.97	80.01



15 – Cylinder head, valve gear

1 Cylinder head

⇒ [“1.1 Assembly overview - cylinder head”, page 44](#)

⇒ [“1.2 Removing and installing cylinder head”, page 47](#)

⇒ [“1.3 Removing and installing cylinder head cover”, page 53](#)

⇒ [“1.4 Checking compression”, page 56](#)

⇒ [“1.5 Removing and installing vacuum pump”, page 57](#)

⇒ [“1.6 Checking delivery pressure of vacuum pump”, page 60](#)

⇒ [“1.7 Checking for internal leaks”, page 62](#)

1.1 Assembly overview - cylinder head

1 - Toothed belt guard upper part

2 - Toothed belt

- ☐ Mark direction of rotation before removing.
- ☐ Check for wear.
- ☐ Do not kink.
- ☐ Removing, installing and tensioning toothed belt (for vehicles ▶ 12.05) ⇒ [page 65](#).
- ☐ Removing, installing and tensioning toothed belt (for vehicles 01.06 ▶) ⇒ [page 73](#).

3 - Bolt

- ☐ Renew after removing.
- ☐ 10 Nm

4 - Bolt

- ☐ 25 Nm

5 - Bolt

- ☐ 100 Nm

6 - Camshaft pulley

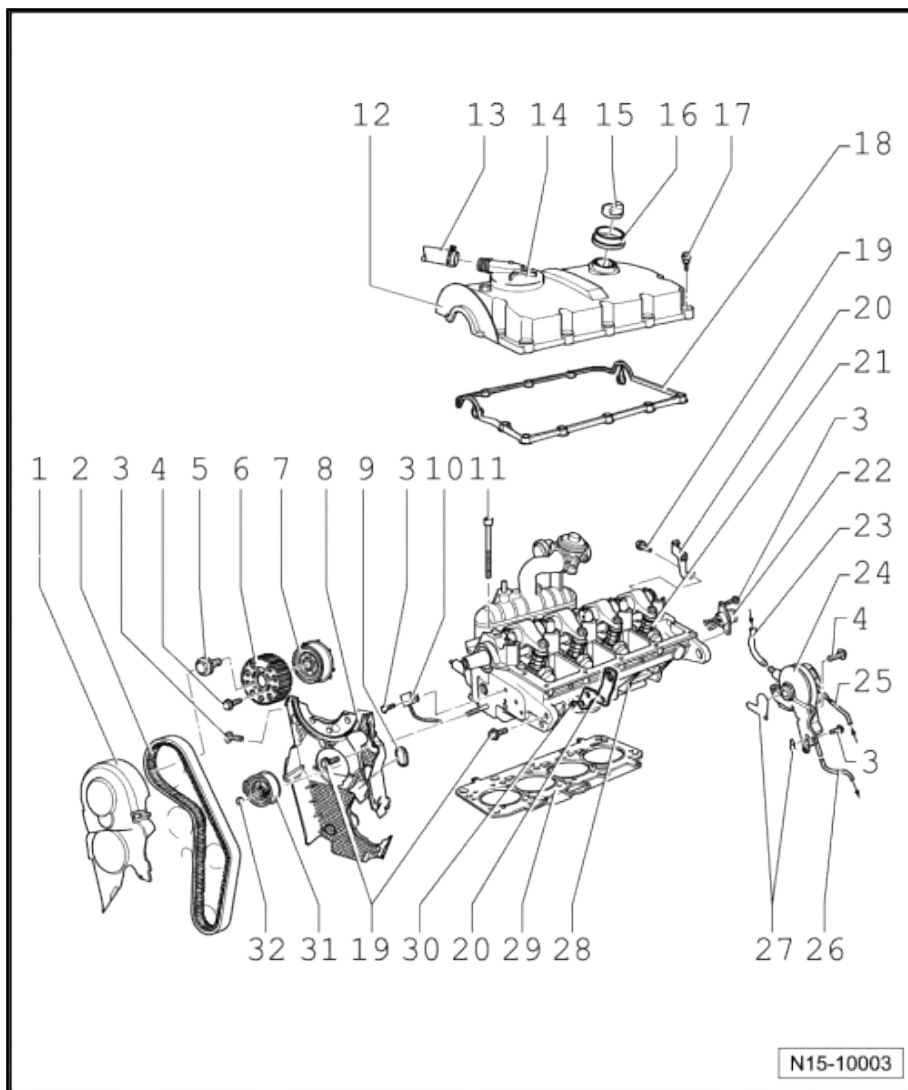
7 - Hub

- ☐ With sender wheel
- ☐ Use counterhold tool - T10051- to loosen and tighten.
- ☐ To remove, use puller - T10052-.
- ☐ Removing and installing ⇒ [page 87](#).

8 - Rear toothed belt guard

9 - Sealing grommet

- ☐ Renew if damaged.





10 - Hall sender - G40-

- ☐ For camshaft position.
- ☐ To remove, unbutton sealing grommet ⇒ [Item 9 \(page 44\)](#) from rear toothed belt guard.
- ☐ Removing and installing ⇒ [page 171](#) .

11 - Cylinder head bolt

- ☐ Renew after removing.
- ☐ Before installing, place washers in cylinder head ⇒ [Item 4 \(page 82\)](#) .
- ☐ Observe sequence when loosening and tightening ⇒ [page 47](#) .

12 - Cylinder head cover

- ☐ Before fitting, thoroughly clean sealing surface of cylinder head with clean cloth.
- ☐ Removing and installing ⇒ [page 53](#) .

13 - Connecting hose to turbocharger

14 - Pressure regulating valve

- ☐ For crankcase ventilation.

15 - Cap

- ☐ Renew seal if damaged.

16 - Seal

- ☐ Only engine codes AXB and AXC
- ☐ Renew if damaged.

17 - Bolt

- ☐ Observe tightening sequence ⇒ [page 53](#) .
- ☐ 10 Nm

18 - Gasket for cylinder head cover

- ☐ Renew if damaged.
- ☐ Before fitting, seal transitions with sealant ⇒ Electronic Parts Catalogue (ETKA) .
- ☐ Removing and installing ⇒ [page 53](#) .

19 - Bolt

- ☐ 20 Nm

20 - Lifting eye

21 - Unit injector

- ☐ Removing and installing ⇒ [page 146](#) .

22 - Central connector

- ☐ For unit injector

23 - From brake servo

24 - Vacuum pump

- ☐ For fuel and vacuum supply.
- ☐ Checking ⇒ [page 60](#) .
- ☐ Removing and installing ⇒ [page 57](#) .

25 - Supply hose

- ☐ White or with white marking.
- ☐ Check for secure seating.
- ☐ Clipped on fuel filter, identification -VM-
- ☐ From fuel filter ⇒ [page 129](#) or ⇒ [page 130](#)

26 - Return hose

- ☐ Blue or with blue marking.
- ☐ Check for secure seating.



- ☐ Clipped on fuel filter, identification -RF-
- ☐ To fuel filter ⇒ [page 129](#) or ⇒ [page 130](#)

27 - Gasket

- ☐ Renew after removing.

28 - Cylinder head

- ☐ After renewing, renew entire coolant.
- ☐ Removing and installing ⇒ [page 47](#) .

29 - Cylinder head gasket

- ☐ Renew after removing.
- ☐ After renewing, renew entire coolant.
- ☐ Note marking ⇒ [page 47](#) .

30 - Glow plug

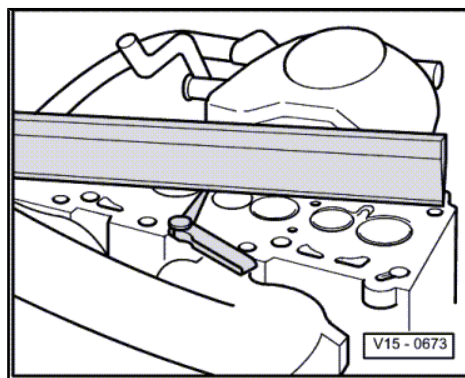
- ☐ 15 Nm
- ☐ Removing and installing, checking ⇒ [page 169](#)

31 - Tensioning roller

32 - Nut

- ☐ 20 Nm +45°

Checking cylinder head for distortion



Special tools and workshop equipment required

- ◆ Straight edge
- ◆ Feeler gauges

Max. permissible distortion: 0.1 mm.

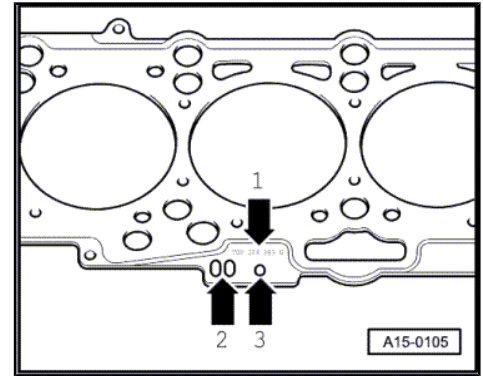


i Note

Reworking diesel cylinder heads is not permissible.

Cylinder head gasket identification

- ◆ Part no. = arrow 1
- ◆ Production control code = arrow 2 (can be disregarded)
- ◆ Holes = arrow 3



i Note

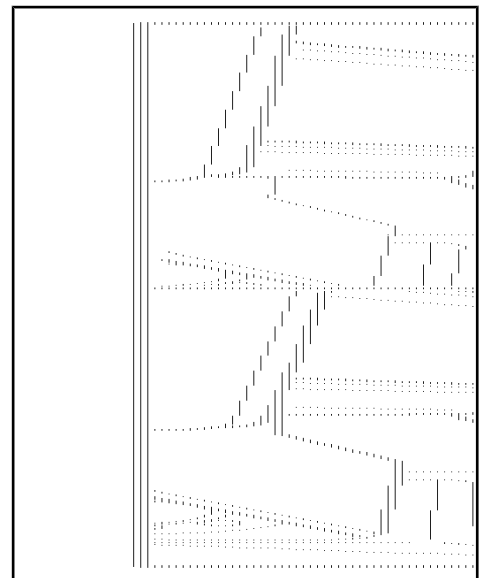
- ◆ *Different thicknesses of cylinder head gasket are fitted depending on the piston projection. When renewing gasket, install new gasket with same identification.*
- ◆ *Piston projection at TDC must be determined when installing new pistons or a short engine ⇒ [page 41](#).*

1.2 Removing and installing cylinder head

i Note

From 01.06 a modified engine support has been introduced, it is no longer necessary to remove the engine support and supporting the engine for the procedure "Removing and installing cylinder head".

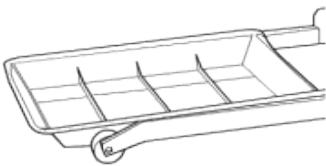


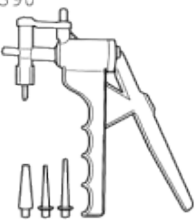

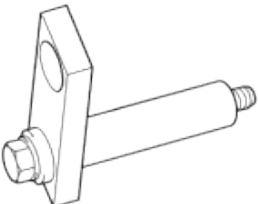
- 1-: Engine support ► 12.05 (removal necessary) ⇒ [page 14](#)
- 2-: Engine support 01.05 ► (removal not necessary).



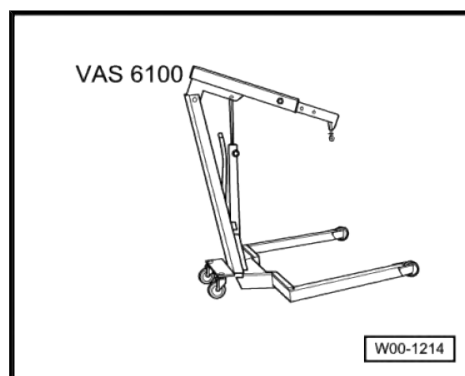


Special tools and workshop equipment required

- ◆ Drip tray - V.A.G 1306- or drip tray for workshop hoist - VAS 6208-
- ◆ Torque wrench - V.A.G 1331-
- ◆ Torque wrench - V.A.G 1332-
- ◆ Hand vacuum pump - V.A.G 1390-
- ◆ Water drainage container - V.A.G 1390/1-
- ◆ Retainer - T10014- (only vehicles ► 12.05)

<p>V.A.G 1306</p> 	<p>V.A.G 1331</p> 
<p>V.A.G 1332</p> 	<p>V.A.G 1390</p> 
<p>V.A.G 1390/1</p> 	<p>T 10014</p>  <p>W15-0127</p>

Only vehicles ► 12.05:



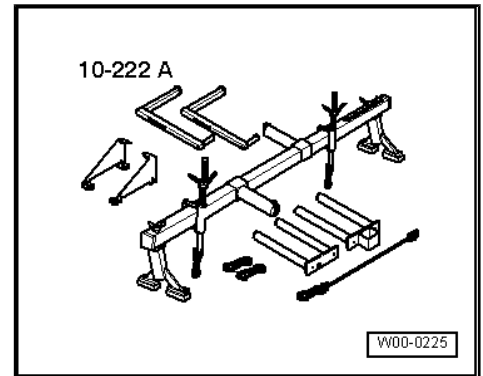


- ◆ Workshop hoist - V.A.G 1202A- or workshop crane - VAS 6100-
- ◆ Support bracket - 10 - 222 A- with adapter - 10 - 222 A /3- , adapter - 10 - 222 A /23- and adapter - 10 - 222 A /16- .



Note

All cable ties which are opened or cut through when cylinder head is removed must be fastened in the same position when cylinder head is installed.



Caution

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- ◆ *Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.*
- ◆ *To avoid damage to lines, ensure sufficient clearance to all moving or hot components.*



Note

- ◆ *When installing an exchange cylinder head with fitted camshaft, the contact surfaces between the bucket tappets and the cam must be oiled before installing the cylinder head cover.*
- ◆ *The plastic protectors fitted to protect the open valves must only be removed immediately before fitting the cylinder head.*
- ◆ *If the cylinder head is renewed, the coolant must also be completely changed.*

Removing



Note

Cylinder heads with cracks between the valve seats may be used without reducing engine life, provided the cracks are small and not more than 0.5 mm wide.

- Drain coolant ⇒ [page 108](#) .



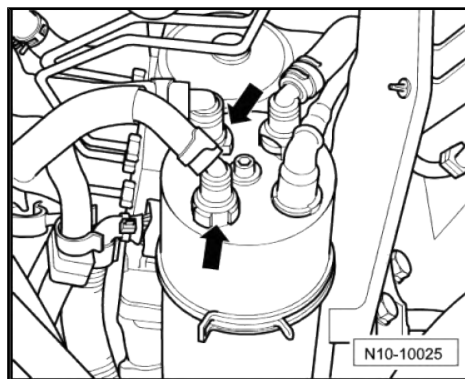
WARNING

In extreme cases, the fuel lines and the fuel can reach a temperature of 100 °C on vehicles with unit injector engine. Allow the fuel to cool down before disconnecting the lines - danger of scalding.

Wear protective gloves and eye protection.



- Disconnect fuel supply and return lines -arrows- at fuel filter.
- Before removing cylinder head extract fuel at vacuum pump using hand vacuum pump - V.A.G 1390- and fluid receptacle - V.A.G 1390/1- ⇒ [page 57](#) .
- Pull vacuum connection off brake servo.
- Unbolt coolant expansion tank from lock carrier.
- Disconnect all connection, coolant, vacuum and intake hoses from cylinder head.
- Pull off or disconnect all electrical connections from cylinder head as necessary and lay them to one side.
- Remove cylinder head cover ⇒ [page 44](#) .
- Remove front exhaust pipe ⇒ [page 158](#) .
- Remove particulate filter (only engine codes BRR and BRS) ⇒ [page 163](#) .
- Remove turbocharger support and oil return from turbocharger.
- Remove oil supply line and lay to side ⇒ [page 103](#) .
- Removing, tensioning toothed belt (for vehicles ► 12.05) ⇒ [page 65](#) .
- Removing, tensioning toothed belt, (for vehicles 01.06 ►) ⇒ [page 73](#) .



Vehicles ► 12.05

- Remove toothed belt tensioning roller.



Note

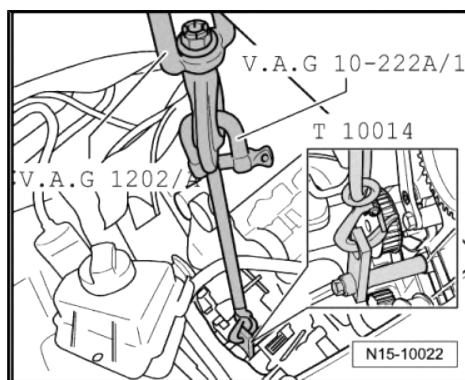
Both lifting eyes for the support bracket are located on the cylinder head. This is the reason why an additional bracket must be attached to the cylinder head to support the engine.

- Screw bracket - T10014- in threaded hole in cylinder block in area of coolant pump.

Specified torque

Component	Specified torque
Bracket - T10014- in cylinder block	20 Nm

- Raise engine slightly using workshop hoist - V.A.G 1202A- or workshop hoist - VAS 6100- until adapter - 10-222A/3- and adapter - 10-222A/16- are relieved.





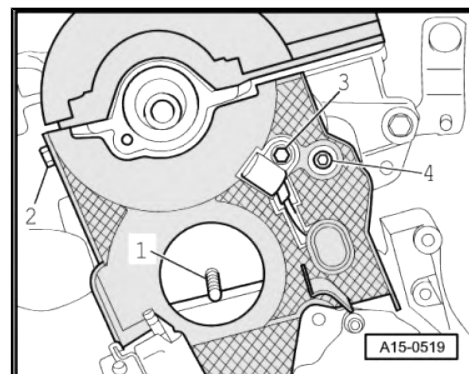
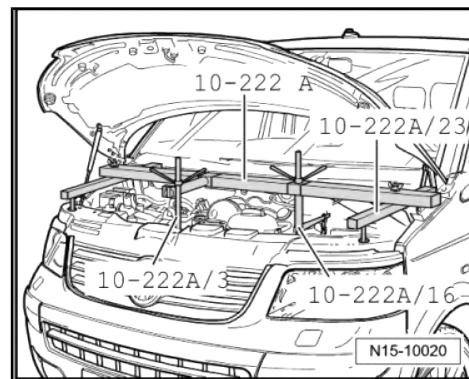
- Unbolt support bracket - 10 - 222 A- with adapter - 10 - 222 A /3- and adapter - 10 - 222 A /16- from adapter - 10 - 222 A / 23- and lay to one side

Vehicles 01.06 ►

- Remove securing bolt for toothed belt tensioner.

Continuation for all vehicles

- Install hub and camshaft pulley ⇒ [page 87](#) .
- Unscrew rear toothed belt guard securing bolts -2- and -4-.
- Unscrew Hall sender - G40- -3-.
- Remove intake manifold ⇒ [page 155](#) .





- Remove cylinder head bolts. Note sequence for this (see figure).
- Lift the cylinder head slightly and remove it from the cylinder block past the side of the toothed belt guard. (Engines 01.06 ➤ toothed belt tensioner remains in engine support).



Note

The cylinder head must be guided carefully to prevent damage.

Installing

Installation is carried out in the reverse order; note the following:



Note

- ◆ *Always renew cylinder head bolts.*
 - ◆ *In cases of repair carefully remove gasket remains from cylinder head and cylinder block. Ensure that no long scores or scratches are made on the surfaces. When using abrasive paper do not use a grade less than 100.*
 - ◆ *Carefully remove remains of emery and abrasives.*
 - ◆ *Do not remove new cylinder head gasket from packaging until it is ready to be fitted.*
 - ◆ *Handle gasket very carefully. Damage to the silicone coating or the indented area will lead to leaks.*
 - ◆ *Engines 01.06 ➤ cylinder head must be fitted so that tensioning roller stud is guided into tensioning roller. To do this, a second person is necessary.*
- Turn crankshaft to TDC marking before fitting cylinder head.
 - Turn crankshaft against engine direction of rotation until all pistons are about the same distance below TDC.
 - Position cylinder head gasket.
 - Fit cylinder head and hand-tighten all cylinder head bolts.

- Tighten cylinder head in 4 stages in sequence shown as follows:

1 - Tighten initially with torque wrench:

Stage I = 35 Nm

Stage II = 60 Nm

2 - Turn further with rigid spanner:

Stage III = $\frac{1}{4}$ turn (90°)

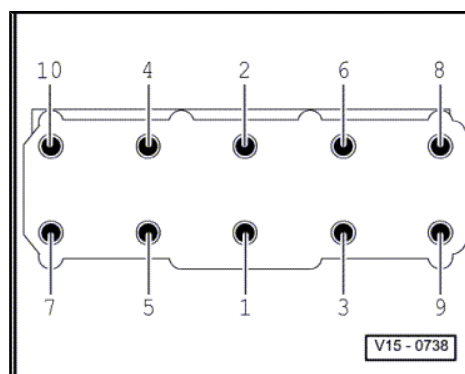
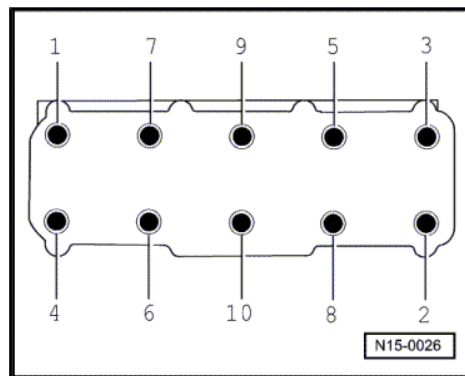
Stage IV = $\frac{1}{4}$ turn (90°)



Note

After repair work it is not necessary to retighten the cylinder head bolts.

- Install hub for camshaft pulley ➤ [page 87](#) .





- When installing camshaft pulley, turn No. 1 cylinder cams -arrows- so that they point evenly upwards. Turn crankshaft, in engine direction of rotation, to TDC marking before fitting toothed belt.
- Bolt intake manifold with new gasket to cylinder head
⇒ [page 155](#) .
- Installing, tensioning toothed belt (for vehicles ► 12.05)
⇒ [page 65](#) .
- Installing, tensioning toothed belt (for vehicles 01.06 ►)
⇒ [page 73](#) .

Vehicles ► 12.05

- Install support bracket - 10 - 222 A- again and unbolt retainer - T10014- .

Continuation for all vehicles

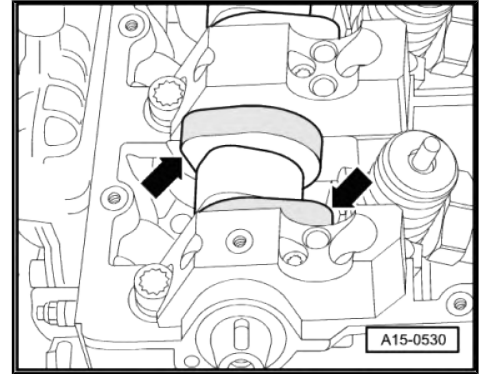
- Install poly V-belt ⇒ [page 17](#) and tensioning element
⇒ [Item 6 \(page 15\)](#) .
- Notes on installing oil supply line ⇒ [page 103](#) .
- Install particulate filter (only engine codes BRR and BRS)
⇒ [page 163](#) .
- Install front exhaust pipe ⇒ [page 158](#) .
- Install turbocharger support and oil return for turbocharger.
- Reconnect all connecting, coolant, vacuum and intake hoses to cylinder head.
- Reconnect all other respective electrical wiring to cylinder head.
- Replenish coolant ⇒ [page 108](#) .
- Install charge air cooler/turbocharger and air filter/turbocharger connecting pipes.
- Install any noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Noise insulation .
- Carry out road test and read event memory afterwards ⇒ Vehicle diagnostic tester.

Specified torques

- ◆ ⇒ [“1.1 Assembly overview - cylinder head”, page 44](#)
- ◆ ⇒ [“2.1 Assembly overview - toothed belt drive”, page 64](#)
- ◆ ⇒ [“2.1 Assembly overview - assembly mountings”, page 14](#)
- ◆ ⇒ [“1.1 Assembly overview - silencers/catalytic converters”, page 158](#)
- ◆ ⇒ [“1.2 Assembly overview - silencers/particulate filter”, page 159](#)
- ◆ Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 50 ; Assembly overview - noise insulation

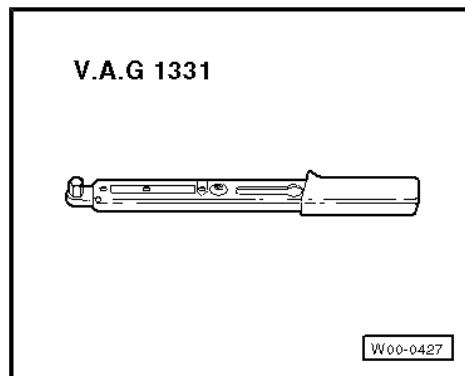
1.3 Removing and installing cylinder head cover

Special tools and workshop equipment required





- ◆ Torque wrench - V.A.G 1331-



- ◆ Sealant ⇒ Electronic Parts Catalogue (ETKA)



Note

Renew cylinder head cover gasket and seal for bolts if damaged.

Removing

- Remove upper toothed belt guard.

Engine codes BRR and BRS

- Remove exhaust gas recirculation connecting pipe
⇒ [Item 3 \(page 168\)](#) .
- Remove intake manifold flap motor - V157-
⇒ [Item 2 \(page 155\)](#) .
- Pull oil dipstick out.

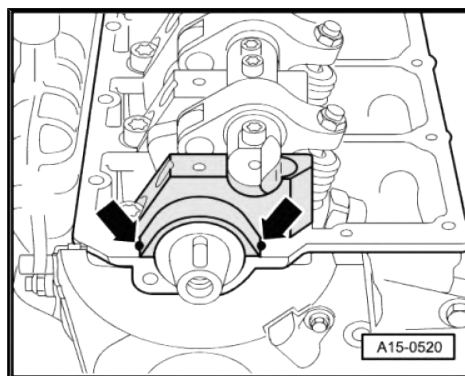
Continuation for all engine codes

- Pull off breather hose for crankcase breather.
- Unbolt cylinder head cover.

Installing

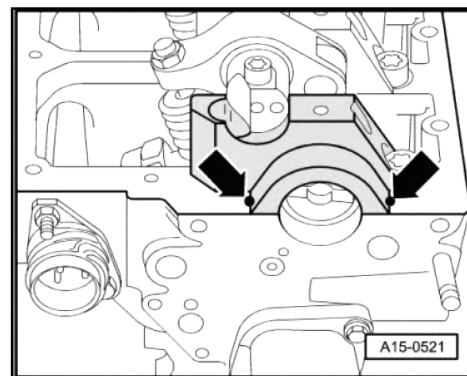
Installation is carried out in the reverse order; note the following:

- Apply a drop of sealant ⇒ Electronic Parts Catalogue (ETKA)
(Ø approx. 5 mm) on edges of both sealing surfaces of bearing cap and cylinder head at front of engine -arrows-.





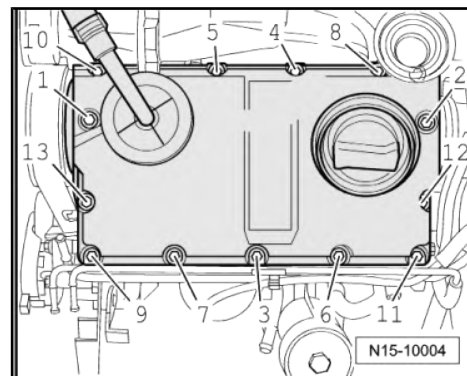
- Apply a drop of sealant \Rightarrow Electronic Parts Catalogue (ETKA) (\varnothing approx. 5 mm) on edges of both sealing surfaces of bearing cap and cylinder head at rear of engine -arrows-.



- Tighten cylinder head cover securing bolts hand tight in sequence as shown.
- Tighten all bolts in sequence as shown.

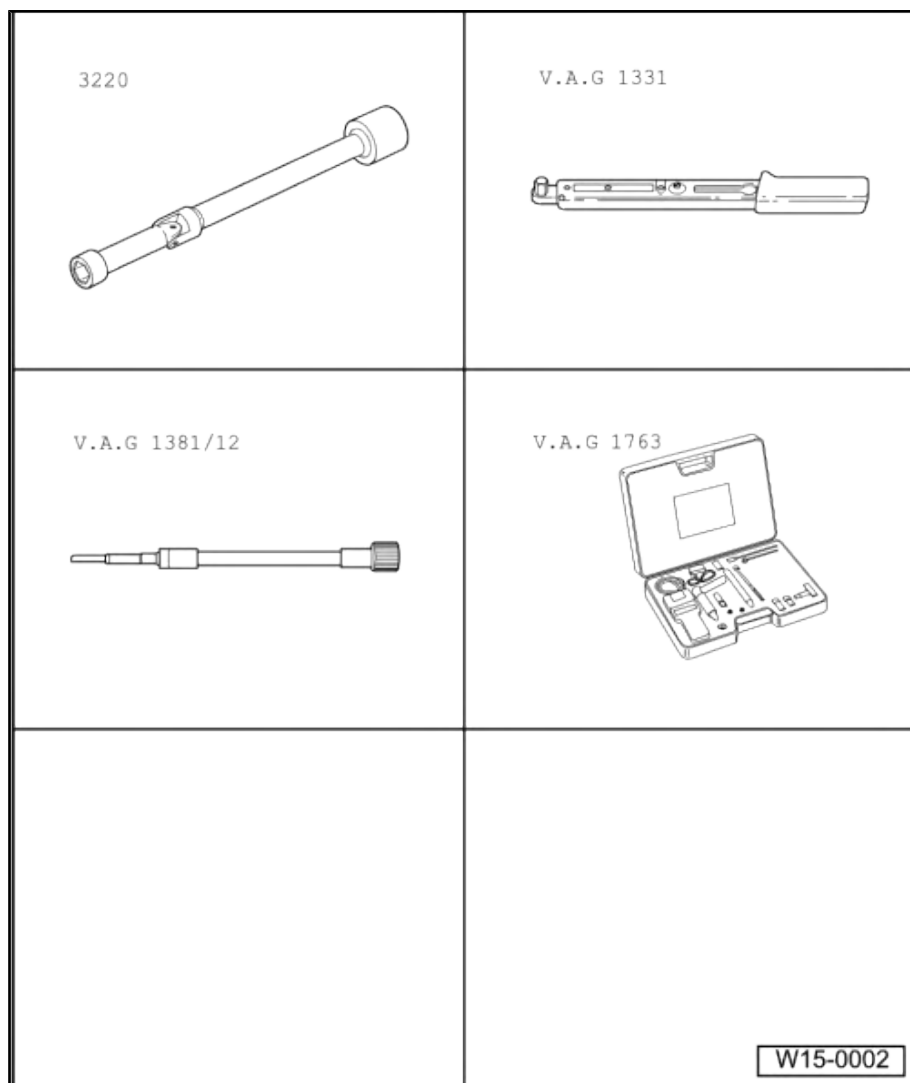
Specified torques

- ◆ \Rightarrow ["1.1 Assembly overview - cylinder head", page 44](#)
- ◆ \Rightarrow ["4.1 Assembly overview - intake manifold, engine codes BRR and BRS", page 155](#)





1.4 Checking compression



Special tools and workshop equipment required

- ◆ Jointed wrench 10 mm - 3220-
- ◆ Torque wrench - V.A.G 1331-
- ◆ Adapter - V.A.G 1381/12-
- ◆ Compression tester - V.A.G 1763-

Test prerequisite

- Engine oil temperature min. 30 °C.

Test procedure

- Detach central connector for unit injectors.
- Remove all glow plugs using 10 mm jointed wrench - 3220- .



- Screw in adapter - V.A.G 1381/12- in place of the glow plugs.
- Check compression using compression tester - V.A.G 1763- .



Note

Using the compression tester ⇒ Operating instructions

- Operate starter until tester shows no further pressure increase.

Compression pressures:

New: 25...31 bar

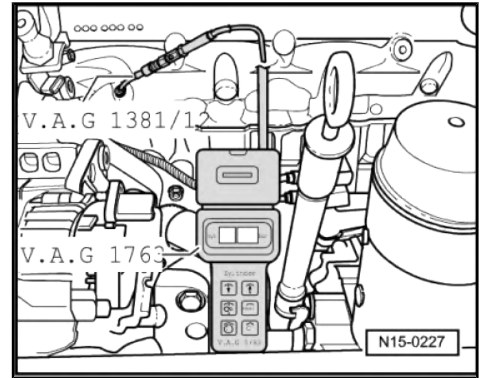
Wear limit: 19 bar.

Maximum permissible difference between all cylinders: 5 bar

- Install all glow plugs using 10 mm jointed wrench - 3220- .
- Read event memory ⇒ Vehicle diagnostic tester.

Specified torques

- ◆ ⇒ ["1.1 Assembly overview - cylinder head", page 44](#)



1.5 Removing and installing vacuum pump



DANGER!


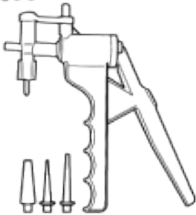

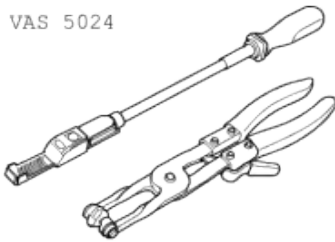
The vacuum pump may, under no circumstances, be dismantled as the vacuum part could otherwise malfunction.

This would result in the failure of the brake servo.



Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1331-
- ◆ Hand vacuum pump - VAS 6213-
- ◆ Water drainage container - V.A.G 1390/1-
- ◆ Spring-type clip pliers - VAS 5024 A-

<p>V.A.G 1331</p> 	<p>V.A.G 1390</p> 
<p>V.A.G 1390/1</p> 	<p>VAS 5024</p> 
	<p>W20-0054</p>

Removing



WARNING

The fuel and the fuel lines in the fuel system can become very hot (danger of scalding)!

Wear protective gloves.



Vehicles with fuel preheating

- Pull supply hose -1- (white marking) and return hose -2- (blue marking) off fuel filter.
- Connect hand vacuum pump - VAS 6213- with water drainage container - V.A.G 1390/1- to return hose -2-.
- Operate hand vacuum pump - VAS 6213- until no more fuel comes out of return hose. Be careful that no fuel is sucked into hand vacuum pump.

Vehicles without fuel preheating

- Pull supply hose off fuel filter.
- Separate return hose connection (blue marking)/return line (brown) next to fuel filter.
- Connect hand vacuum pump - VAS 6213- with water drainage container - V.A.G 1390/1- to return hose.
- Operate hand vacuum pump - VAS 6213- until no more fuel comes out of return hose. Be careful that no fuel is sucked into hand vacuum pump.

Continuation for all vehicles

- Remove coolant expansion tank and place to one side (leaving hoses connected).
- Remove charge air pipe between intake manifold and charge air cooler.
- Detach brake servo vacuum line -1- from vacuum pump -4-.
- Detach fuel supply line -2- from vacuum pump -4-.
- Unscrew securing bolts -arrows-.
- Remove vacuum pump -4- from cylinder head.
- Pull tandem pump upwards slightly and remove fuel line -3- from vacuum pump -4-.

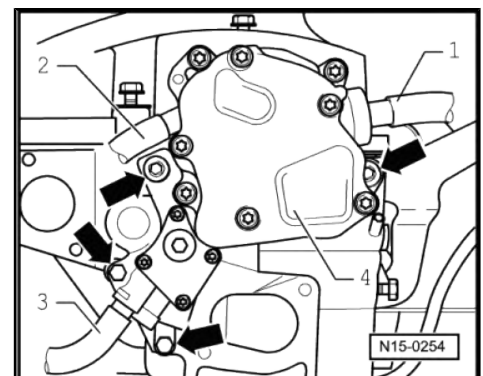
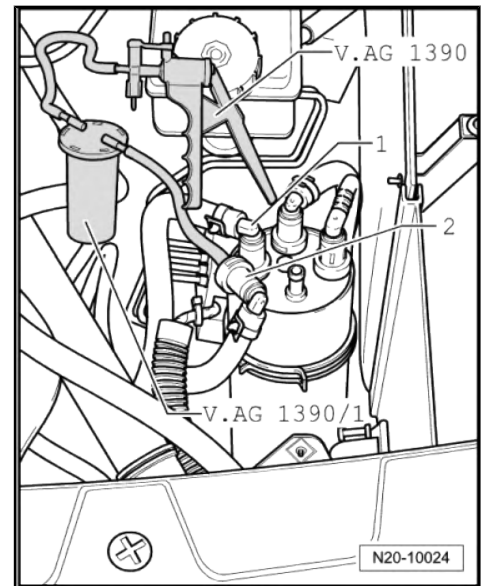
Installing

Installation is carried out in the reverse order; note the following:



Note

- ◆ *Ensure that vacuum pump coupling seats properly in shaft.*
- ◆ *Always renew vacuum pump seals.*
- Install vacuum pump and tighten upper securing bolts.
- Tighten lower securing bolts .





- Connect return hose (blue or with blue marking) -3- and vacuum line -1- to vacuum pump.
- Connect supply hose (black) to supply connection -2- and brake servo vacuum line -1- to vacuum pump -4-.

Vehicles with fuel preheating

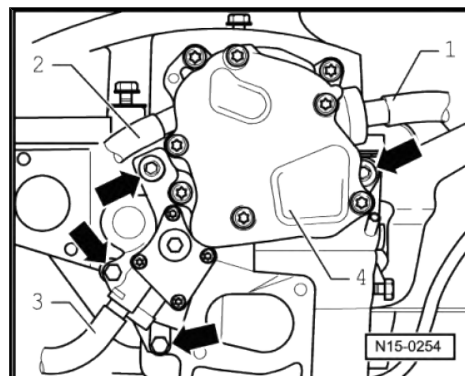
- Connect supply hose ⇒ [Item 3 \(page 129\)](#) and return hose ⇒ [Item 2 \(page 129\)](#) to fuel filter.

Vehicles without fuel preheating

- Pull supply hose ⇒ [Item 2 \(page 131\)](#) off fuel filter.
- Connect return hose to return line.

Continuation for all vehicles

- Install charge air pipe between intake manifold and charge air cooler.
- Secure coolant expansion tank.



Note

The vacuum pump must always be checked for internal leaks between fuel side and oil side after reinstalling a used vacuum pump ⇒ [page 62](#).

- Bleed fuel system ⇒ Maintenance ; Booklet 19.1 .
- Carry out road test and read event memory ⇒ Vehicle diagnostic tester.

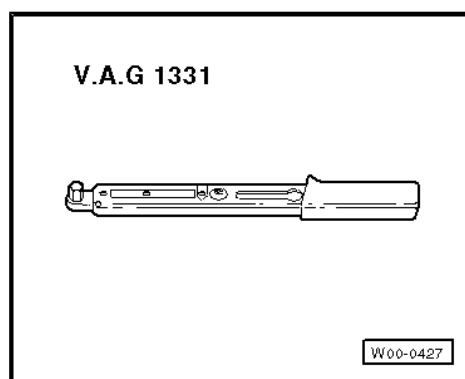
Specified torques

- ♦ ⇒ [“1.1 Assembly overview - cylinder head”, page 44](#)

1.6 Checking delivery pressure of vacuum pump

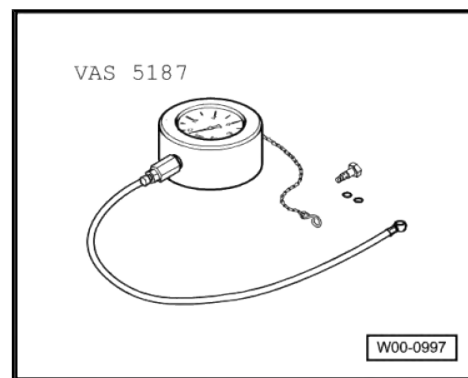
Special tools and workshop equipment required

- ♦ Torque wrench - V.A.G 1331-





- ◆ Tandem pump tester - VAS 5187- with adapter - VAS 5187/7-



Special tools and workshop equipment required

- ◆ Vehicle diagnosis tester

Test prerequisites

- Coolant temperature must be at least 85 °C.
- Unit injectors OK.
- Fuel filter and fuel lines must not be blocked.

Procedure

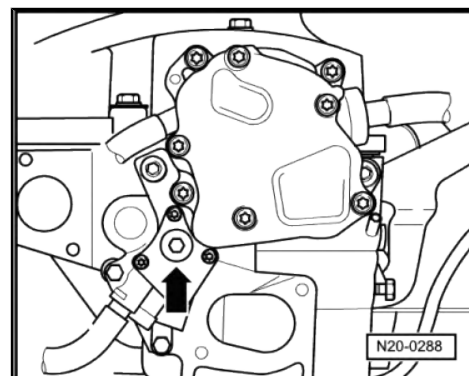


WARNING

The fuel and the fuel lines in the fuel system can become very hot (danger of scalding)!

Wear protective gloves.

- Unscrew plug -arrow-.





- Connect tandem pump tester - VAS 5187- with adapter - VAS 5187/7- as shown.
- Start engine and run at idling speed.
- Connect ⇒ Vehicle diagnostic tester.
- Select Read measured value block in Engine electronics.
- Read off idling speed in ⇒ Vehicle diagnostic tester.
- Increase speed to 4000 rpm.
- Check displayed pressure on pressure gauge.

Specification: at least 7.5 bar

If the specification is not attained:

- Using a hose clamp, clamp off return line between fuel filter and vacuum pump.
- Increase speed to 4000 rpm.
- Check displayed pressure on pressure gauge.

Specification: at least 7.5 bar

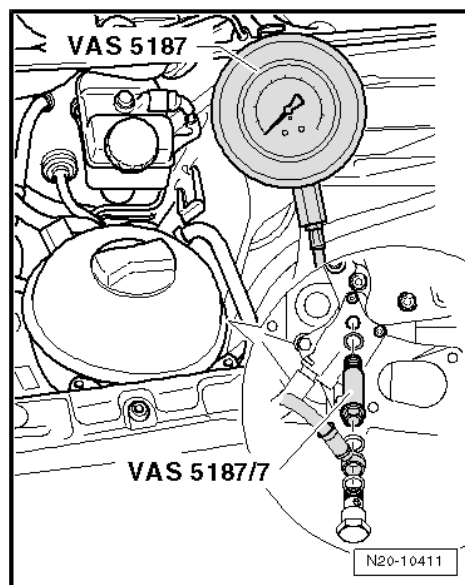
If specification is now obtained:

Pressure loss at unit injectors.

- Renew O-rings for unit injectors ⇒ [page 144](#) .

If the specification is not attained:

- Renew vacuum pump ⇒ [page 57](#) .



Note

After removing pressure gauge, tighten sealing. Renew seal always.

Specified torques

- ♦ ⇒ ["1.1 Assembly overview - cylinder head", page 44](#)

1.7 Checking for internal leaks



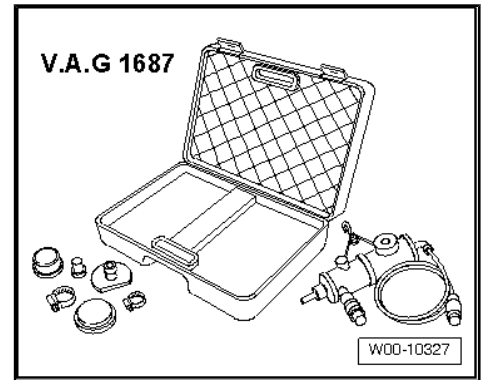
Note

The vacuum pump must be checked for internal leaks between fuel side and oil side after reinstalling a used vacuum pump, e.g. after renewing or repairing a cylinder head and/or when installing a "short" engine. In the event of a leak, it is possible for the fuel to mix with the oil which may cause engine damage.

Special tools and workshop equipment required



◆ Charge air system tester - V.A.G 1687-



Procedure

- Pull fuel supply hose (white marking) and fuel return hose (blue marking) off vacuum pump.
- Seal fuel return connection on vacuum pump with a plug. Secure blind plug with spring-type clip.

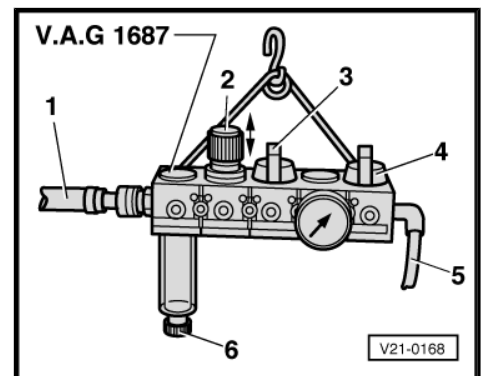
Prepare charge air system tester - V.A.G 1687- as follows:

- Unscrew pressure control valve -2- completely and close valves -3- and -4-.
- Connect test connection -5- to fuel supply connection of vacuum pump using commercially available compressed air connection and a section of fuel hose. Secure by means of spring-type clip.



Note

To turn the pressure regulating valve -2- the knob must be pulled upwards.

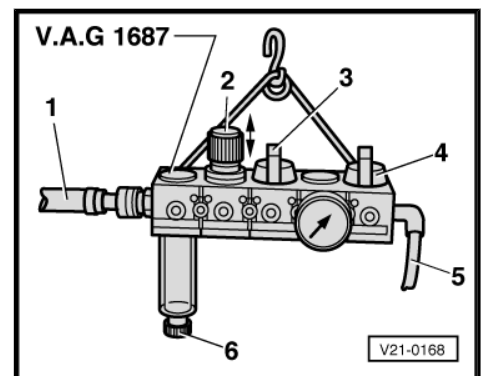


- Connect compressed air hose -1- (compressed air supply) to charge air system tester - V.A.G 1687- .



Note

If water is in inspection glass, drain via drain screw -6-.



- Open valve -3-.
- Adjust pressure to 1.0 bar with pressure control valve -2-.



Caution

The maximum test pressure is 1.3 bar and this must not be exceeded.

- Open valve -4- and wait until test circuit is full. If necessary, regulate pressure to 1.0 bar.
- Close valve -3- to maintain pressure and observe pressure drop over a period of 1 minute.

If the pressure does not drop the vacuum pump can be reused, if the pressure drops the vacuum pump must be renewed.



2 Toothed belt drive

⇒ "2.1 Assembly overview - toothed belt drive", page 64

⇒ "2.2 Removing and installing toothed belt, vehicles ▶ 12.05", page 65

⇒ "2.3 Removing and installing toothed belt, vehicles 01.06 ▶", page 73

2.1 Assembly overview - toothed belt drive

1 - Toothed belt guard upper part

2 - Toothed belt

- ☐ Mark direction of rotation before removing.
- ☐ Check for wear.
- ☐ Do not kink.
- ☐ Removing, installing and tensioning toothed belt (for vehicles ▶ 12.05) ⇒ [page 65](#).
- ☐ Removing, installing and tensioning toothed belt (for vehicles 01.06 ▶) ⇒ [page 73](#).

3 - Nut

- ☐ 20 Nm +45°

4 - Tensioning roller

5 - Bolt

- ☐ 100 Nm

6 - Bolt

- ☐ 25 Nm

7 - Camshaft pulley

8 - Hub

- ☐ With sender wheel
- ☐ Use counterhold tool - T10051- to loosen and tighten.
- ☐ To remove, use puller - T10052-.
- ☐ Removing and installing ⇒ [page 87](#).

9 - Bolt

- ☐ Renew after removing.
- ☐ 10 Nm

10 - Rear toothed belt guard

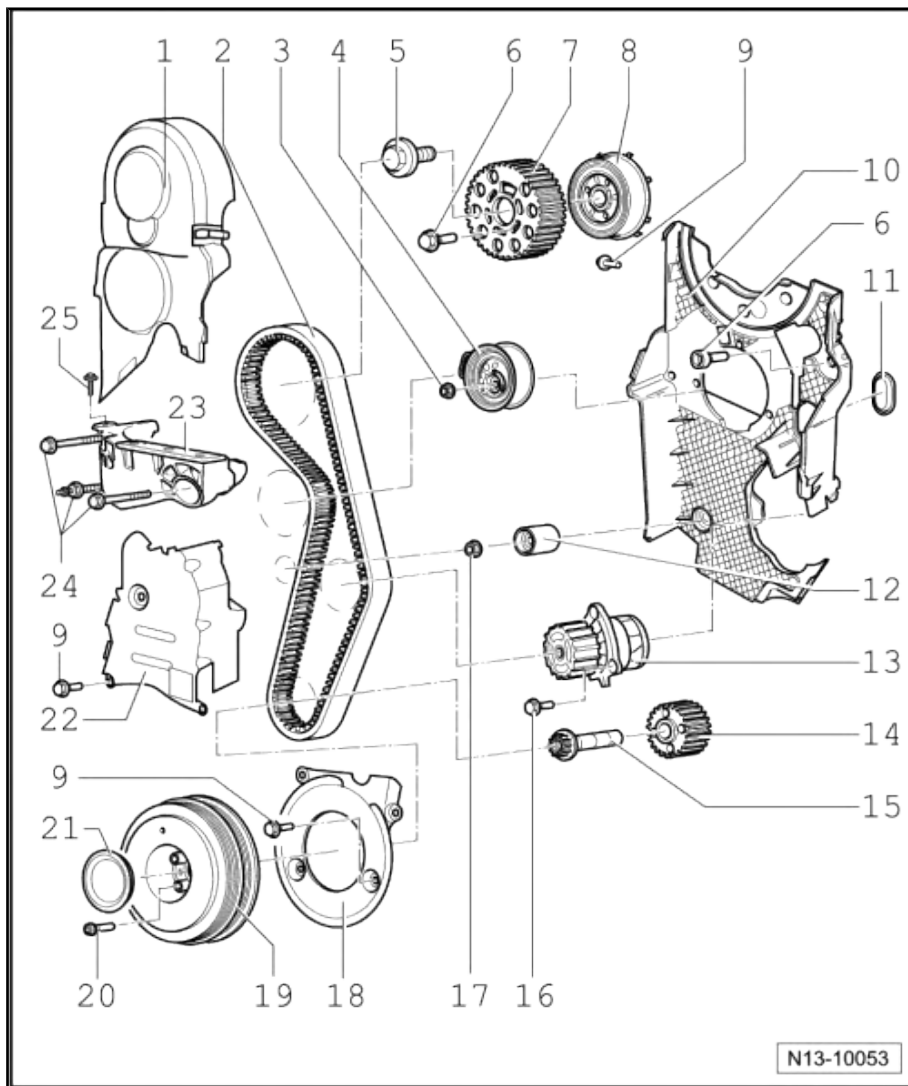
11 - Sealing grommet

- ☐ Renew if damaged.

12 - Idler roller

13 - Coolant pump

- ☐ Removing and installing ⇒ [page 114](#).





14 - Crankshaft toothed belt pulley

15 - Bolt

- ☐ Renew after removing.
- ☐ Do not additionally oil or grease thread and shoulder.
- ☐ Turning further can be done in several stages.
- ☐ Use counterhold for toothed belt pulley - 3099- to loosen and tighten
- ☐ 120 Nm + 90°

16 - Bolt

- ☐ 15 Nm

17 - Nut

- ☐ 20 Nm

18 - Toothed belt guard lower part

19 - Belt pulley and vibration damper

- ☐ Can only be installed in one position. Holes are offset.

20 - Bolt

- ☐ 10 Nm + 90°

21 - Cover

- ☐ Renew if damaged.

22 - Toothed belt guard centre part

23 - Engine mounting

24 - Bolt

- ☐ Renew after removing.
- ☐ 40 Nm +180°

25 - Bolt

- ☐ Securing point for charge air cooler connecting pipe.
- ☐ 10 Nm

2.2 Removing and installing toothed belt, vehicles ► 12.05



Note

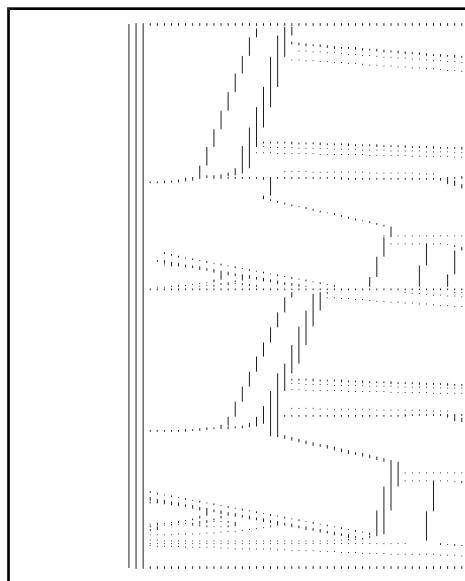
From 01.06 a modified engine support has been introduced, it is no longer necessary to remove the engine support and support the engine for the procedure "Removing, installing and tensioning toothed belt".

-1-: Engine support ► 12.05 (removal necessary) ⇒ [page 14](#)



-2-: Engine support 01.06 ► (removal not necessary).

Removing

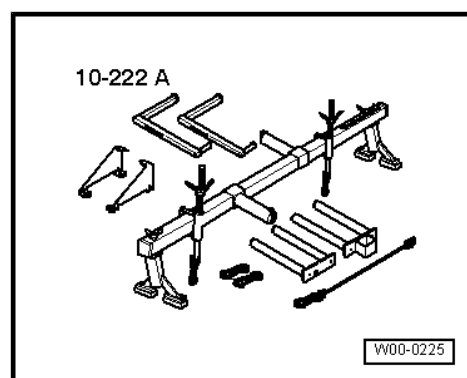
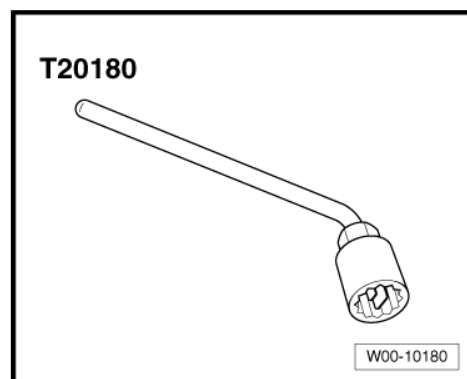
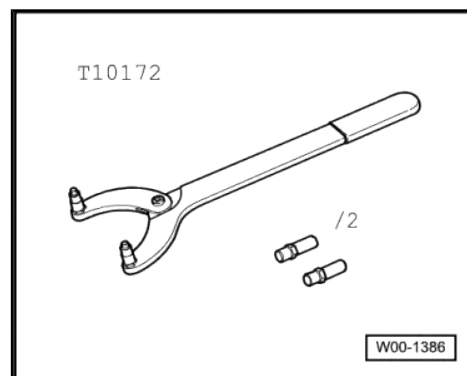


Special tools and workshop equipment required

- ◆ Diesel injection pump locking pin - 3359-
- ◆ 2-hole pin wrench - T10020-
- ◆ Locking pin - T10115-
- ◆ Crankshaft stop - T10050-
- ◆ Torque wrench - V.A.G 1331-
- ◆ Torque wrench - V.A.G 1332-

<p>3359</p>	<p>T 10020</p>
<p>T10115</p>	<p>T10050</p>
<p>V.A.G 1331</p>	<p>V.A.G 1332</p>

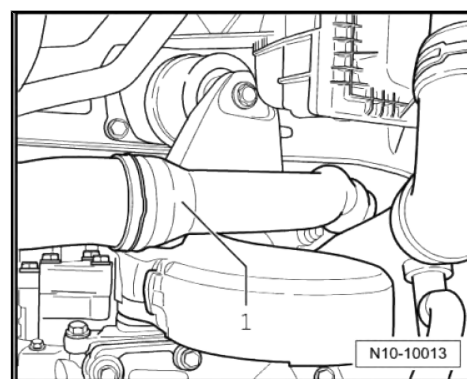
W15-10001



- ◆ Counterhold tool - T10172-
- ◆ Special wrench, long reach - T10264-
- ◆ Support bracket - 10 - 222 A- with adapter - 10 - 222 A /23- and adapter - 10 - 222 A /16-

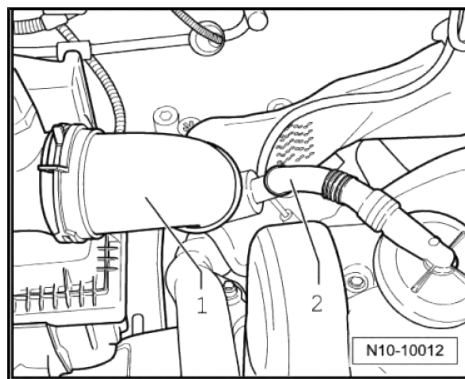
Removing

- Remove bulkhead on left and right ⇒ General body repairs, exterior; Rep. gr. 50 ; Plenum chamber bulkhead .
- Unbolt right cover and battery cover from lock carrier ⇒ Rep. gr. 63 .
- Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Body, front; Noise insulation .
- Remove charge air pipe -1- between charge air cooler and turbocharger.
- Carefully cover or seal open ends.

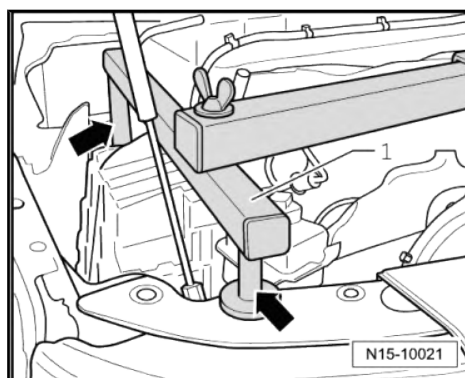




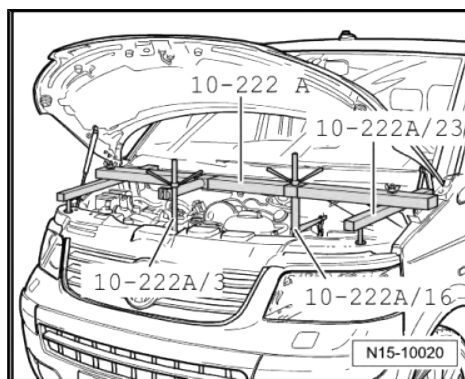
- Remove connecting hose -1- from air filter and crankcase breather hose -2-.
- Remove poly V-belt ⇒ [page 17](#) .
- Remove pin from poly V-belt tensioning element.
- Remove tensioning element ⇒ [Item 6 \(page 15\)](#) .
- Remove upper toothed belt guard.
- Remove vibration damper/belt pulley ⇒ [Item 4 \(page 15\)](#) .
- Unclip cover caps on suspension strut turret.



- Fit adapter - 10 - 222 A /23- -1- on foremost suspension strut turret and on lock carrier -arrows-.



- Bolt support bracket - 10 - 222 A- to respective adapter - 10-222A/23-
- Support engine on lifting eyes on cylinder head, using adapter - 10 - 222 A /23- and adapter - 10 - 222 A /16-

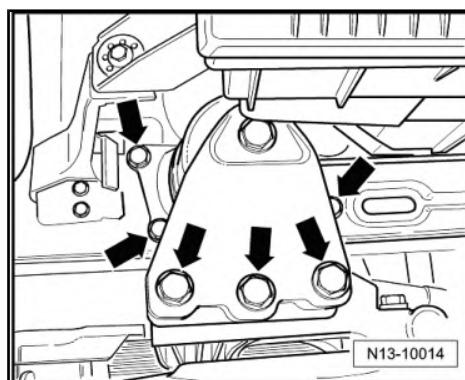


- Remove securing bolts from assembly mounting to engine bracket, assembly mounting to body -arrows- and completely remove assembly mounting.



Note

- ◆ *The assembly mounting may only be removed if the engine is supported with support bracket - 10 - 222 A- !*
- ◆ *The engine bracket must be loosened only when the assembly mounting has been removed.*



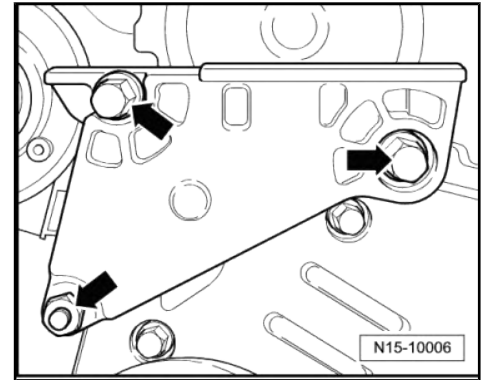


- Unbolt engine bracket from cylinder block -arrows- and re-move.

i Note

- ◆ *When loosening both upper engine bracket bolts the engine must be raised slightly with the support bracket.*
- ◆ *When loosening the lower engine bracket bolt the engine must be lowered slightly with the support bracket.*

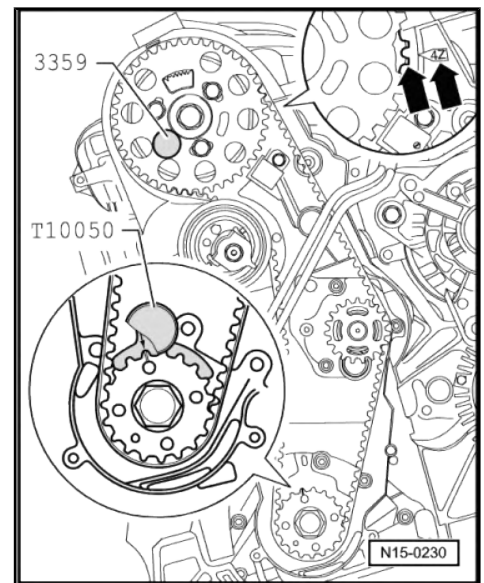
- Remove centre and lower toothed belt guards.
- Set engine to TDC No. 1 cylinder.



i Note

Turn crankshaft until marking on crankshaft toothed belt pulley and tooth segment of camshaft pulley is on top. The arrow on the rear toothed belt guard must align with the markings on the camshaft sender wheel -arrows-.

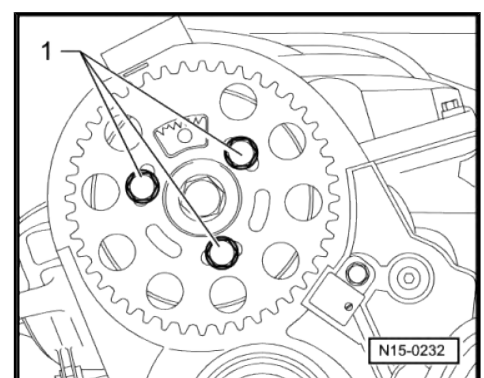
- Lock hub with diesel injection pump locking pin - 3359- . To do this, insert locking pin - 3359- through free elongated hole on left into hole in cylinder head.
- Lock crankshaft toothed belt pulley in position with crankshaft stop - T10050- . To do this, push crankshaft stop - T10050- into teeth of toothed belt pulley from latter's face side.



i Note

The markings on the crankshaft toothed belt pulley and the crankshaft stop must align. At the same time, the pin of the crankshaft stop - T10050- must engage in the drilling in the sealing flange.

- Mark direction of rotation of toothed belt.
- Loosen securing bolts -1- of camshaft pulley until camshaft pulley can be moved within elongated holes.
- Loosen tensioning roller securing nut.

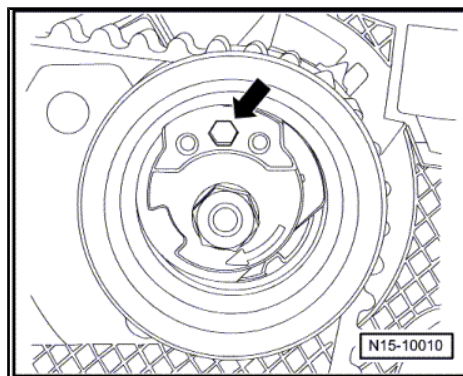




Note

From 01.06 ➤, a new toothed belt tensioner is installed. The tensioner has an additional hexagon hole -arrow-. Use angle driver - T10264- instead of 2-hole pin wrench - T10020- to loosen and tension the toothed belt. This does not alter the procedure.

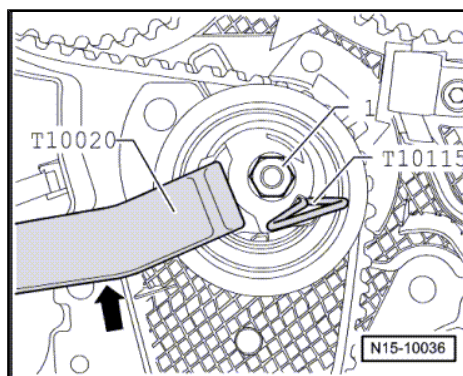
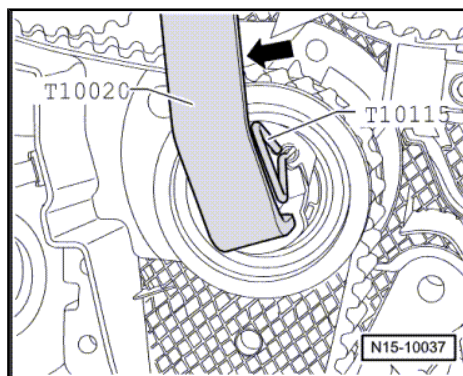
- Turn 2-hole pin wrench - T10020- anti-clockwise until toothed belt tensioning roller can be locked using locking pin - T10115- .



- Turn 2-hole pin wrench - T10020- clockwise as far as stop and hand-tighten securing nut -1-.
- Remove toothed belt first from coolant pump and then from remaining toothed pulleys.

Installing

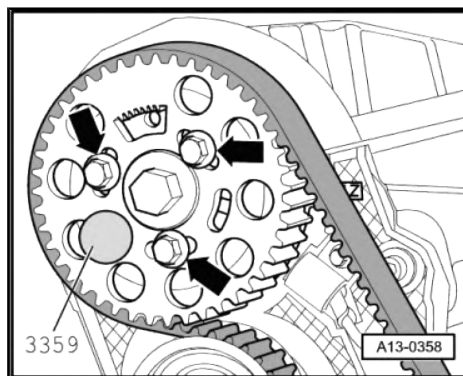
- Camshaft locked with locking pin - 3359- .
- Crankshaft locked in position with crankshaft stop - T10050- .
- Tensioning roller locked with locking pin - T10115- and secured to right stop.



Note

Adjustment work on toothed belts must be performed only on cold engines, as the indicator position on the tensioning element varies depending on the engine temperature.

- Turn camshaft pulley in its elongated holes to centre position -arrows-.
- Fit toothed belt to crankshaft toothed belt pulley, tensioning roller, camshaft pulley and idler roller.
- Finally, fit toothed belt on coolant pump toothed belt pulley.

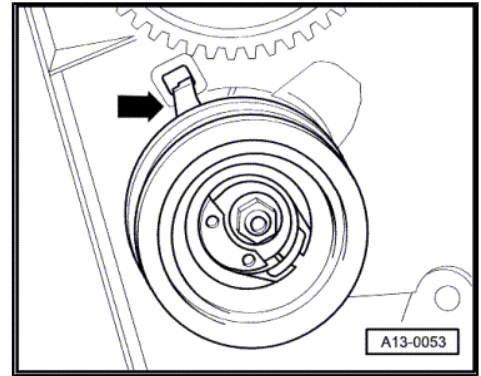




Note

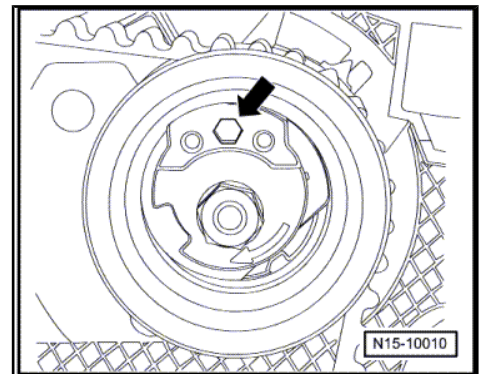
Ensure that belt tensioner seats correctly in rear toothed belt guard -arrow-.

- Undo securing nuts of tensioning roller and pull out locking pin - T10115- .



Note

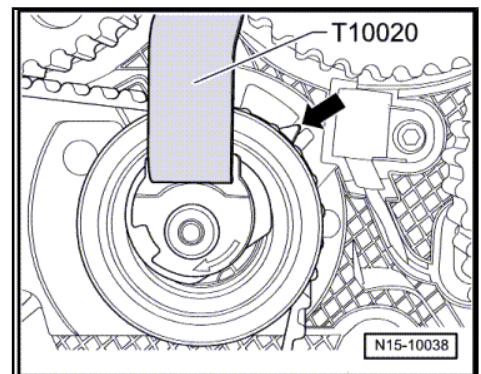
From 01.06 ➤, a new toothed belt tensioner is installed. The tensioner has an additional hexagon hole -arrow-. Use angle driver - T10264- instead of 2-hole pin wrench - T10020- to loosen and tension the toothed belt. This does not alter the procedure.



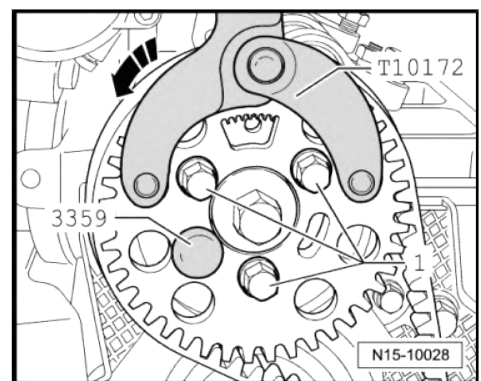
- Now carefully turn tensioning roller clockwise using 2-hole pin wrench - T10020- until indicator is in middle of gap in base plate -arrow-.

Ensure that securing nut does not turn as well.

- Hold tensioning roller in this position and tighten securing nut of tensioning roller.



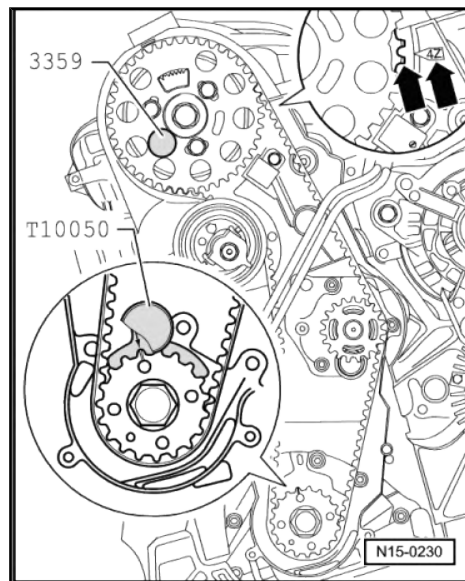
- Fit counterhold - T10172- with pin - T10172/4- as shown. Press counter-hold tool - T10172- in direction of arrow and keep camshaft sprocket in pretensioning position.
- In this position, tighten camshaft pulley securing bolts -1-.
- Remove locking pin - 3359- and crankshaft stop - T10050- .
- Turn crankshaft two revolutions in direction of engine rotation until crankshaft is just before TDC for No. 1 cylinder.



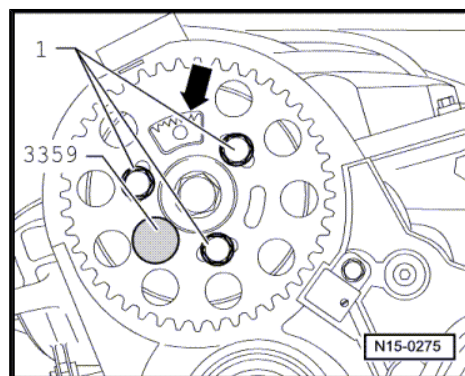


- Lock hub with locking pin - 3359- whilst turning engine in direction of rotation.
- Check whether crankshaft can be locked with crankshaft stop - T10050- .

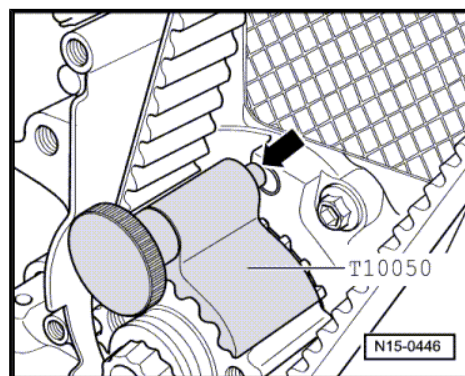
If crankshaft cannot be locked:



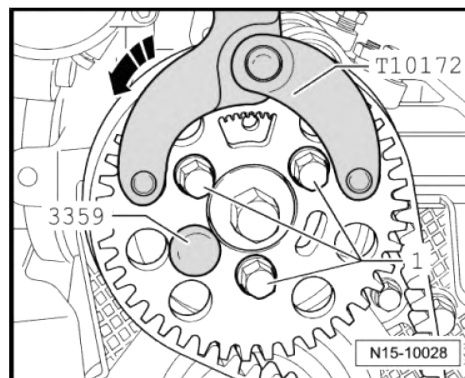
- Loosen securing bolts -1- of camshaft pulley.



- Turn crankshaft slightly against direction of engine rotation until pin of crankshaft stop - T10050- is positioned just before hole in sealing flange -arrow-.
- Now turn crankshaft in direction of engine rotation until pin of crankshaft stop - T10050- engages in sealing flange whilst turning.



- Fit counterhold - T10172- with pin - T10172/4- as shown. Press counter-hold tool - T10172- in direction of arrow and keep camshaft pulley in pretensioning position.
- In this position, tighten camshaft pulley securing bolts -1-.
- Remove locking pin - 3359- and crankshaft stop - T10050- .
- Turn crankshaft two revolutions in direction of engine rotation until crankshaft is just before TDC for No. 1 cylinder.
- Repeat measurement.
- Install lower toothed belt guard and vibration damper/belt pulley ➤ [Item 4 \(page 15\)](#) .
- Install middle toothed belt guard.

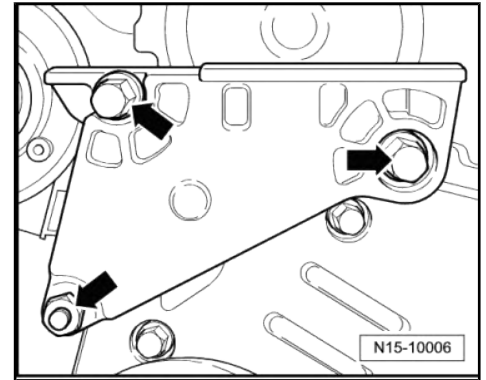




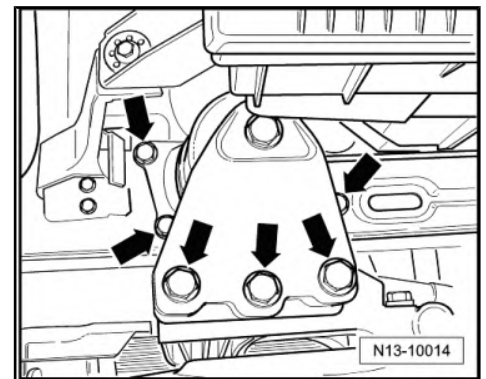
- Using new securing bolts -arrows-, mount engine bracket on cylinder block and tighten securing bolts.

i Note

Before installing assembly mounting, tighten all engine bracket bolts to specified torque.



- Install assembly mounting between engine and body (renew securing bolts) ⇒ [page 14](#) .
- Fit engine assembly mounting to engine bracket by bringing contact surfaces together using support bracket - 10 - 222 A- and tighten ⇒ [page 14](#) .
- Install poly V-belt ⇒ [page 17](#) .
- Install tensioning element ⇒ [Item 6 \(page 15\)](#) .
- Install upper toothed belt guard.
- Install charge air cooler/turbocharger and air filter/turbocharger connecting pipes.
- Install any noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Noise insulation .
- Install bulkhead on left and right ⇒ General body repairs, exterior; Rep. gr. 50 ; Plenum chamber bulkhead .
- Install right cover and battery cover on lock carrier.



Specified torques

- ◆ ⇒ [“2.1 Assembly overview - toothed belt drive”, page 64](#)
- ◆ ⇒ [“2.1 Assembly overview - assembly mountings”, page 14](#)
- ◆ ⇒ [“1.1 Assembly overview - poly V-belt drive”, page 15](#)
- ◆ ⇒ [“2.1 Assembly overview - charge air system”, page 139](#)
- ◆ Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 50 ; Assembly overview - noise insulation

2.3 Removing and installing toothed belt, vehicles 01.06 ►

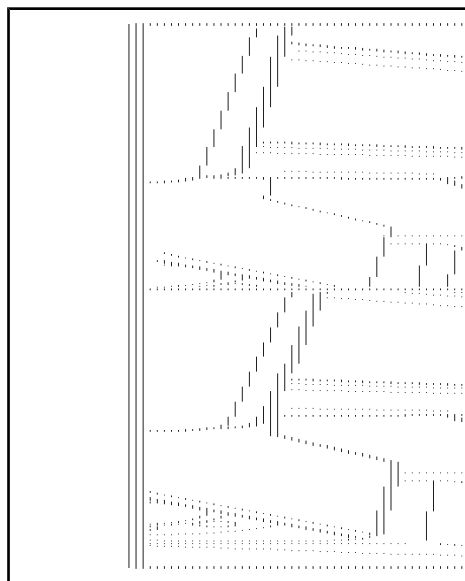
i Note

From 01.06 a modified engine support has been introduced, it is no longer necessary to remove the engine support and support the engine for the procedure "Removing, installing and tensioning toothed belt".

- 1-: Engine support ► 12.05 (removal necessary) ⇒ [page 14](#)

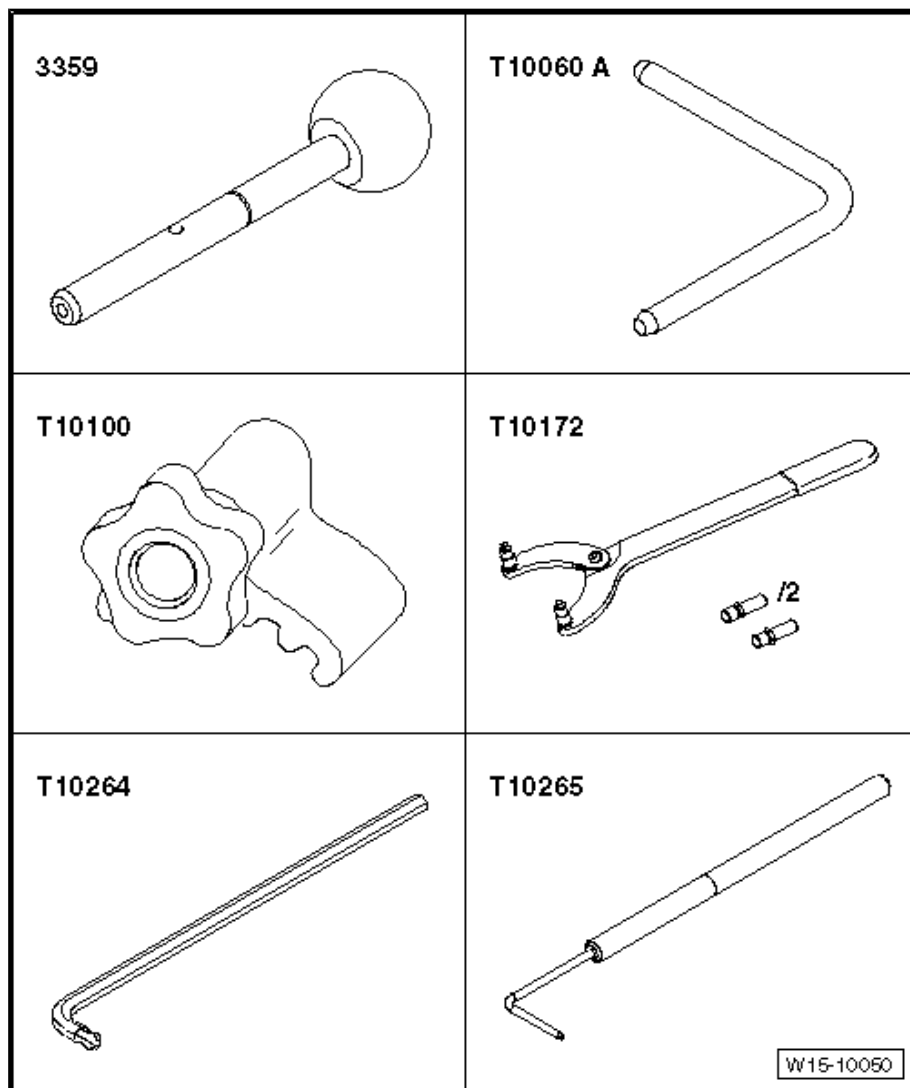


-2-: Engine support 01.06 ► (removal not necessary).



Special tools and workshop equipment required

- ◆ Diesel injection pump locking pin - 3359-
- ◆ Locking pin - T10060 A-
- ◆ Crankshaft stop - T10100- (for oval crankshaft toothed belt pulley)
- ◆ Counterhold tool - T10172-
- ◆ Special wrench, long reach - T10264-
- ◆ Locking tool - T10265-





- ◆ Crankshaft stop - T10050- (for round crankshaft toothed belt pulley)

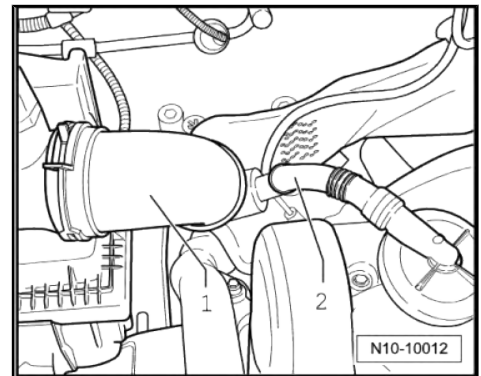
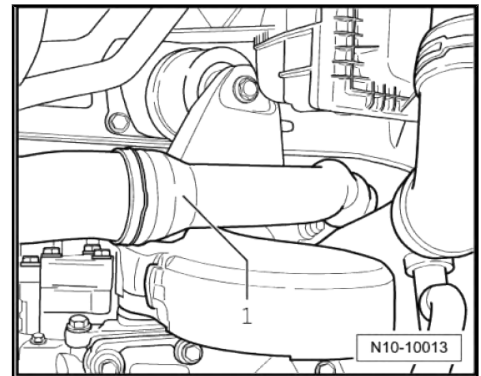
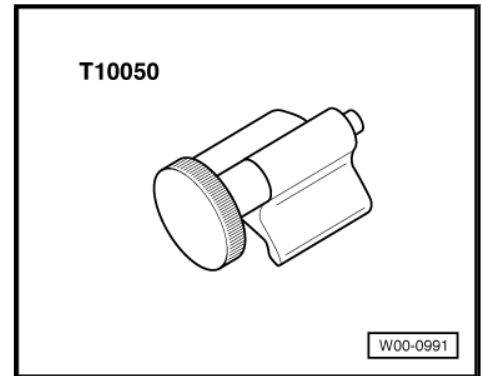
Removing

- Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Noise insulation .
- Remove charge air pipe -1- between charge air cooler and turbocharger.
- Carefully cover or seal open ends.
- Remove connecting hose -1- from air filter and crankcase breather hose -2-.
- Remove poly V-belt ⇒ [page 17](#) .
- Remove poly V-belt tensioning element.
- Remove upper toothed belt guard.
- Remove vibration damper/belt pulley ⇒ [Item 4 \(page 15\)](#) .
- Remove lower and centre toothed belt guards



Note

*Gradual introduction of oval crankshaft toothed belt pulleys.
When installing this toothed belt pulley, the crankshaft stop -
T10100- must be installed to determine the TDC position.*





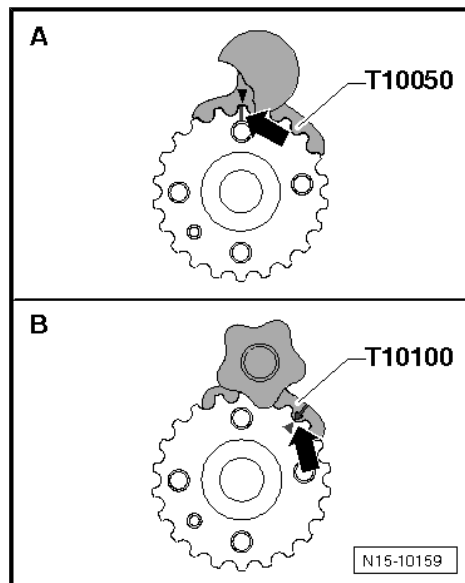
Characteristics of crankshaft toothed belt pulley:

A = Round toothed belt pulley, lock using crankshaft stop - T10050-, TDC marking at 12 o'clock

B = Oval toothed belt pulley, lock using crankshaft stop - T10100-, TDC marking at 1 o'clock

Vehicles with round crankshaft toothed belt pulley:

- Set engine to TDC No. 1 cylinder.



Note

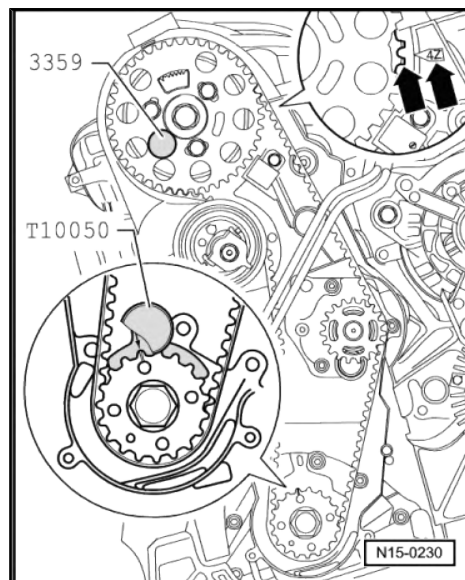
Turn crankshaft until marking on crankshaft toothed belt pulley and tooth segment of camshaft pulley is on top. The arrow on the rear toothed belt guard must align with the markings on the camshaft sender wheel -arrows-.

- Lock hub with diesel injection pump locking pin - 3359- . To do this, insert locking pin - 3359- through free elongated hole on left into hole in cylinder head.
- Lock crankshaft toothed belt pulley in position with crankshaft stop - T10050- . To do this, push crankshaft stop - T10050- into teeth of toothed belt pulley from latter's face side.



Note

The marks on the crankshaft pulley and the crankshaft stop - T10050- must be aligned. At the same time, the pin of the crankshaft stop - T10050- must engage in the drilling in the sealing flange.



Vehicles with oval crankshaft toothed belt pulley:

- Set engine to TDC No. 1 cylinder.



Note

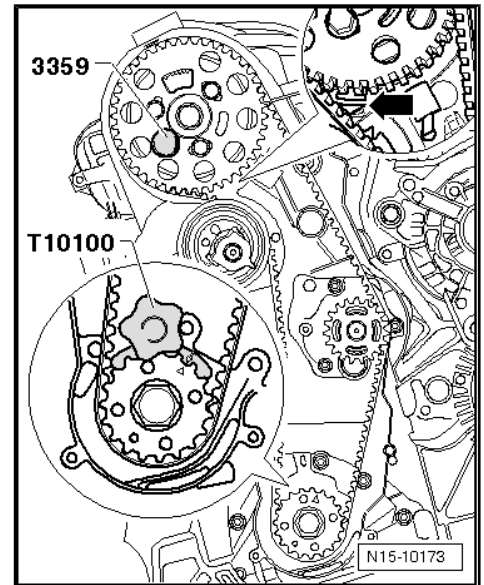
Turn crankshaft until marking on crankshaft toothed belt pulley and tooth segment of camshaft pulley is on top. The marking on the rear toothed belt guard must align with the marking on the camshaft sender wheel -arrow-.

- Lock hub with diesel injection pump locking pin - 3359- . To do this, insert locking pin - 3359- through free elongated hole on left into hole in cylinder head.
- Lock crankshaft toothed belt pulley in position with crankshaft stop - T10100- . To do this, push the crankshaft stop into the teeth of the toothed belt pulley from the latter's face side..



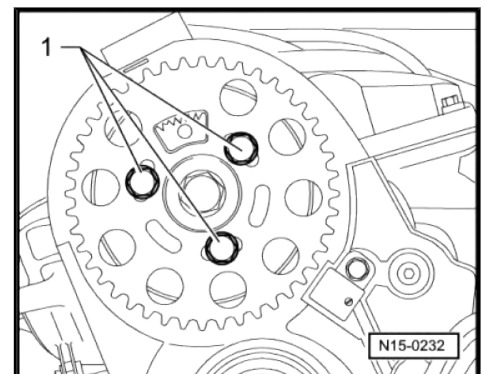
Note

The marks on the crankshaft toothed belt pulley and the crankshaft stop must align. When doing this, the pin of the crankshaft stop must engage in the drilling of sealing flange.

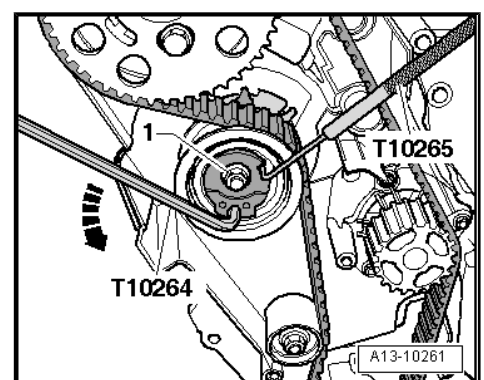


Continuation for all vehicles

- Mark direction of rotation of toothed belt.
- Loosen securing bolts -1- of camshaft pulley until camshaft pulley can be moved within elongated holes.



- Loosen tensioning roller securing nut -1-.
- Turn eccentric of tensioning roller anti-clockwise -arrow- using socket - T10264- , until the tensioning roller can be locked with locking tool - T10265- .



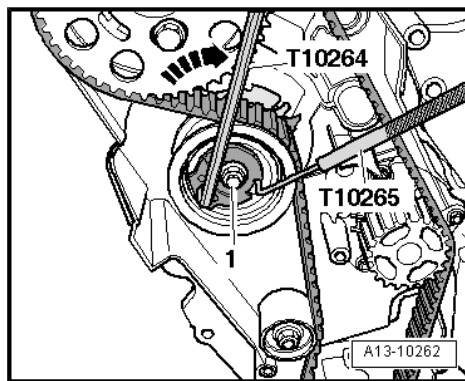


- Turn belt tensioner eccentric clockwise -arrow- to stop. Hand-tighten securing bolt -1-.
- Remove toothed belt first from coolant pump and then from remaining toothed belt pulleys.

Installing

Installation is carried out in the reverse order; note the following:

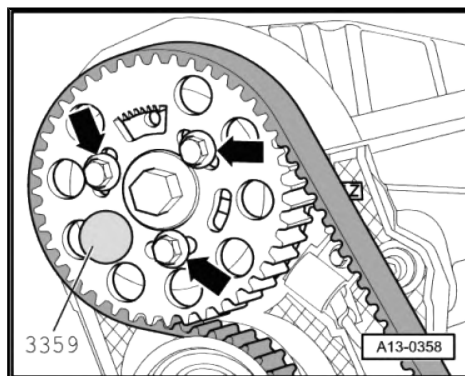
- Camshaft locked with locking pin - 3359- .
- Crankshaft locked with crankshaft stop - T10050- or crankshaft stop - T10100- .
- Tensioning roller locked with locking pin - T10265- and secured to right stop with securing nut.



Note

Adjustment work on toothed belts must be performed only on cold engines, as the indicator position on the tensioning element varies depending on the engine temperature.

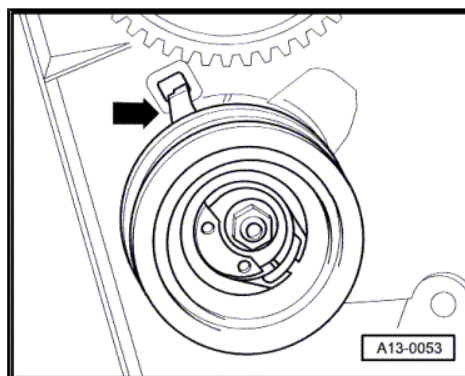
- Turn camshaft pulley in its elongated holes to centre position -arrows-.
- Guide toothed belt through gap between engine support and engine.
- Fit toothed belt to crankshaft toothed belt pulley, tensioning roller, camshaft pulley and idler roller.
- Finally, fit toothed belt on coolant pump toothed belt pulley.



Note

Ensure that belt tensioner seats correctly in rear toothed belt guard -arrow-.

- Pull out the locking pin - T10265- from the tension roller.



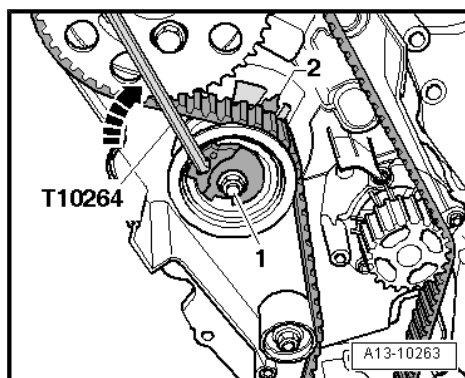
- Loosen tensioning roller securing nut -1-.
- Carefully turn eccentric of tensioning roller clockwise -arrow- using angled screwdriver - T10264- until indicator -2- is in the middle of gap in base plate.



Note

Ensure that securing nut does not turn as well.

- Hold tensioning roller in this position and tighten nut of tensioning roller.





- Fit counterhold - T10172- with pin - T10172/4- as shown in illustration, and keep the toothed belt under tension on pulling side, by pressing in -direction of arrow-.
- Tighten bolts -1- of camshaft pulley.
- Remove locking pin - 3359- .

Vehicles with round crankshaft toothed belt pulley:

- Remove crankshaft stop - T10050- .
- Turn crankshaft two revolutions in direction of engine rotation until crankshaft is just before TDC for No. 1 cylinder.
- Lock hub with locking pin - 3359- whilst turning engine in direction of rotation.
- Check whether crankshaft can be locked with crankshaft stop - T10050- .

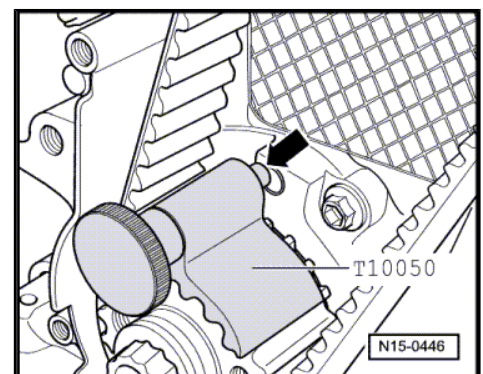
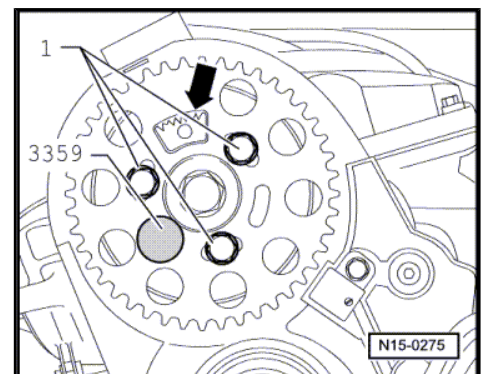
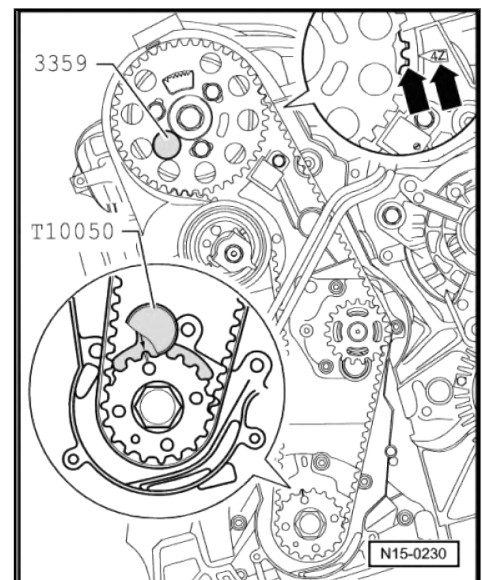
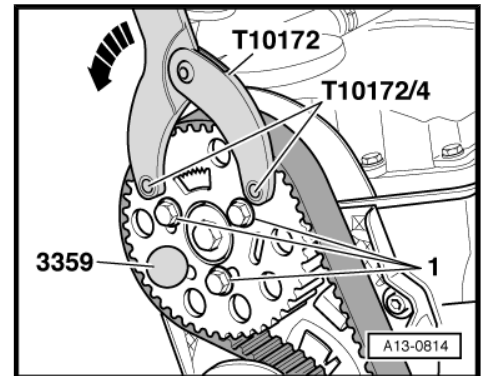
If crankshaft cannot be locked:

- Loosen securing bolts -1- of camshaft pulley.

- Turn crankshaft slightly against direction of engine rotation until pin of crankshaft stop - T10050- is positioned just before hole in sealing flange -arrow-.
- Turn crankshaft in direction of engine rotation until crankshaft stop - T10050- pin engages in sealing flange whilst turning.

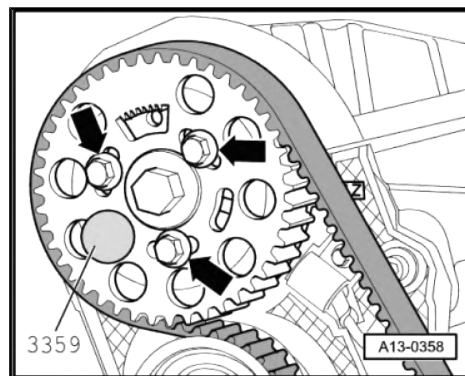
Vehicles with oval crankshaft toothed belt pulley:

- Remove crankshaft stop - T10100- .
- Turn crankshaft 2 rotations in direction of engine rotation until crankshaft is just before TDC again.



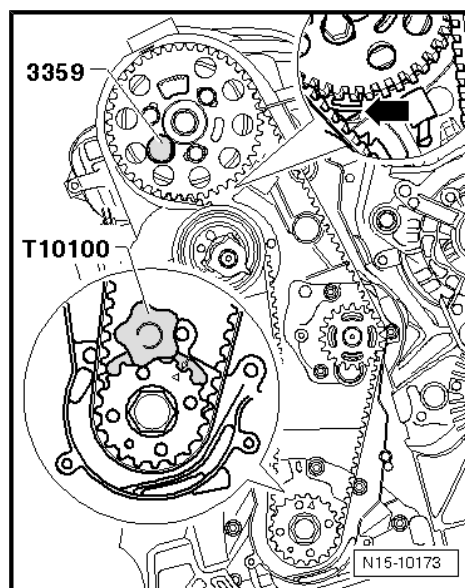


- Lock camshaft hub with diesel injection pump locking pin - 3359- whilst turning engine in direction of engine rotation.

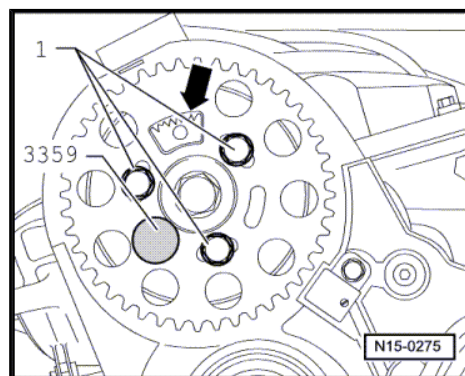


- Check whether crankshaft can be locked with crankshaft stop - T10100- .

If crankshaft cannot be locked:

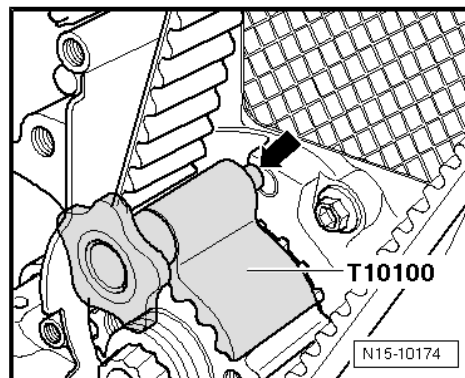


- Loosen securing bolts -1- of camshaft pulley.



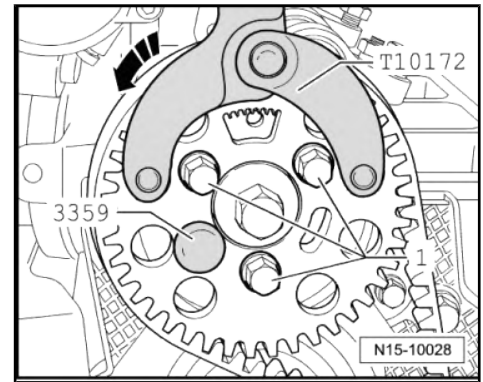
- Turn crankshaft slightly against direction of engine rotation until pin of crankshaft stop - T10100- is positioned just before hole in sealing flange -arrow-.
- Turn crankshaft in engine direction of rotation until crankshaft stop - T10100- pin arrow engages in sealing flange whilst turning.

Continuation for all vehicles





- Fit counterhold - T10172- with pin - T10172/4- as shown. Press counter-hold tool - T10172- in direction of arrow and keep camshaft pulley in pretensioning position.
- In this position, tighten camshaft pulley securing bolts -1-.
- Remove locking pin - 3359- and crankshaft stop - T10050- or crankshaft stop - T10100- .
- Turn crankshaft two revolutions in direction of engine rotation until crankshaft is just before TDC for No. 1 cylinder.
- Check and, if necessary, repeat adjustment.
- Remove middle and lower toothed belt guards.
- Install vibration damper/belt pulley.
- Install upper toothed belt guard.
- Install tensioning element ⇒ [Item 6 \(page 15\)](#) .
- Install poly V-belt ⇒ [page 17](#) .
- Install charge air cooler/turbocharger and air filter/turbocharger connecting pipes.
- Install any noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Noise insulation .



Specified torques

- ◆ ⇒ [“2.1 Assembly overview - toothed belt drive”, page 64](#)
- ◆ ⇒ [“1.1 Assembly overview - poly V-belt drive”, page 15](#)
- ◆ ⇒ [“2.1 Assembly overview - charge air system”, page 139](#)
- ◆ Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 50 ; Assembly overview - noise insulation



3 Valve gear

⇒ "3.1 Assembly overview - valve gear", page 82

⇒ "3.2 Measuring axial clearance of camshaft", page 83

⇒ "3.3 Removing and installing camshaft oil seal", page 85

⇒ "3.4 Removing and installing camshaft", page 87

⇒ "3.5 Removing and installing valve stem seal", page 92

3.1 Assembly overview - valve gear

1 - Bolt

- ☐ Renew after removing.
- ☐ Observe sequence when loosening and tightening ⇒ [page 87](#).
- ☐ 20 Nm + 90°

2 - Rocker arm shaft

- ☐ Do not interchange.
- ☐ Removing and installing ⇒ [page 87](#).

3 - Cylinder head bolt

- ☐ Renew after removing.
- ☐ Before installing, insert washers ⇒ [Item 4 \(page 82\)](#) in cylinder head.
- ☐ Observe sequence when loosening and tightening ⇒ [page 47](#).

4 - Washer

- ☐ For cylinder head bolts.
- ☐ Insert in cylinder head before installing bearing caps

5 - Bucket tappet

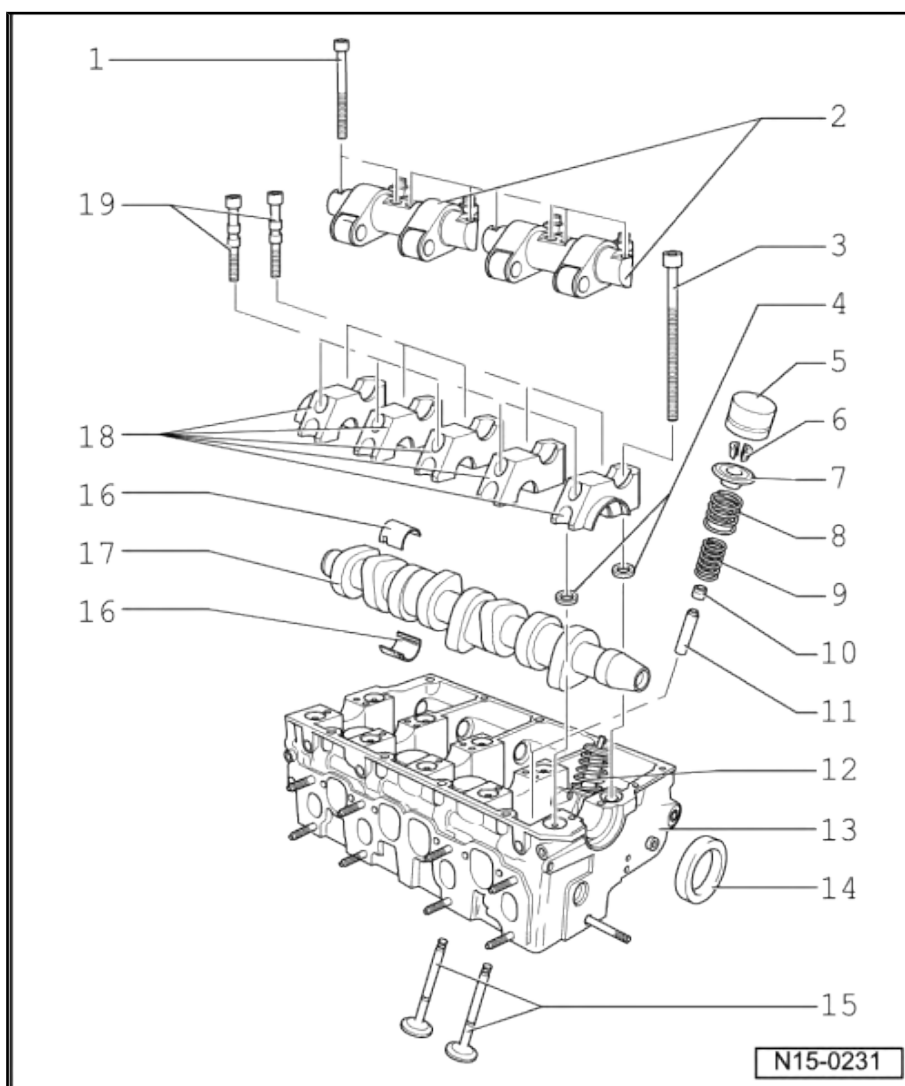
- ☐ Do not interchange.
- ☐ With hydraulic valve clearance compensation.
- ☐ Set down with contact surface facing downwards.
- ☐ Oil contact surface.
- ☐ Before removing, remove camshaft bearing caps
- ☐ Before installing, check camshaft axial clearance ⇒ [page 83](#).

6 - Cotters

7 - Valve spring plate

8 - Outer valve spring

- ☐ Removing and installing:
- ☐ Cylinder head removed, with valve spring compressor - 2037- installed: ⇒ [page 92](#)





9 - Inner valve spring

- ☐ Removing and installing:
- ☐ Cylinder head removed, with valve spring compressor - 2037- installed: ⇒ [page 92](#)

10 - Valve stem seal

- ☐ Renew. ⇒ [page 92](#) .

11 - Valve guide

- ☐ Checking ⇒ [page 94](#) .

12 - Unit injector

- ☐ Removing and installing ⇒ [page 146](#) .

13 - Cylinder head

- ☐ See note ⇒ [page 82](#) .

14 - Seal

- ☐ Do not additionally oil or grease the oil seal sealing lip.
- ☐ Before installing, remove residual oil from camshaft journal using a clean cloth.
- ☐ To install, tape over groove in taper of camshaft (e.g. using Sellotape).
- ☐ Removing and installing ⇒ [page 85](#) .

15 - Valves

- ☐ Valve dimensions ⇒ [page 84](#)

16 - Bearing shell

- ☐ Do not interchange used bearing shells (mark).
- ☐ Ensure that retaining lugs are correctly seated in bearing caps and cylinder head

17 - Camshaft

- ☐ Checking radial clearance with Plastigage; wear limit: 0.11 mm.
- ☐ Runout: max. 0.01 mm.
- ☐ Checking axial clearance ⇒ [page 83](#) .
- ☐ Removing and installing ⇒ [page 87](#) .

18 - Bearing cap

- ☐ Installation sequence ⇒ [page 87](#) .
- ☐ Seal bearing caps 1 and 5 with sealant as per ⇒ Electronic Parts Catalogue (ETKA) ⇒ [page 84](#) .

19 - Bolt

- ☐ Renew after removing.
- ☐ 8 Nm + 90°

3.2 Measuring axial clearance of camshaft

Special tools and workshop equipment required

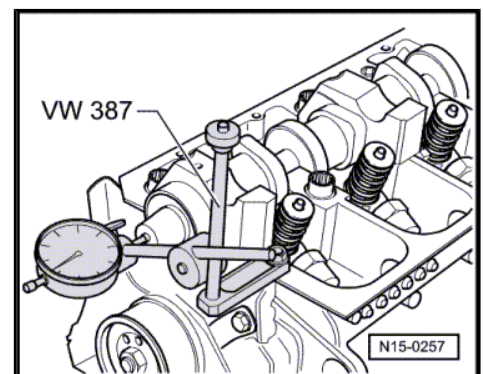
- ◆ Universal dial gauge bracket - VW 387-
- ◆ Dial gauge

Checking camshaft axial clearance

Test procedure

- Check with bucket tappets removed and with first, third and last bearing caps fitted.

Wear limit: max. 0.15 mm





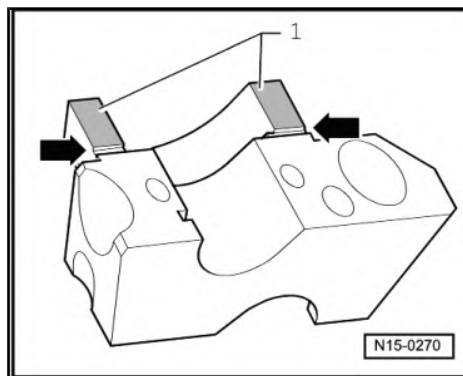
Seal parting surfaces of bearing caps 1 and 5 with sealant

- Apply sealant ⇒ Electronic Parts Catalogue (ETKA) thinly and evenly on surfaces -1-.



Note

Be careful and ensure that no sealant gets into grooves -arrows-.



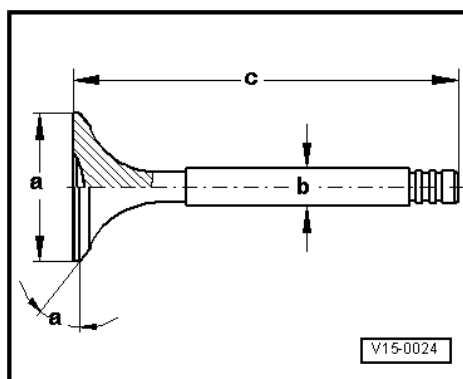
Valve dimensions



Note

Valves must not be reworked. Only lapping-in is permitted.

Dimension		Inlet valve	Exhaust valve
Ø a	mm	35.95	31.45
Ø b	mm	6.980	6.956
c	mm	89.95	89.95
α	°	45	45

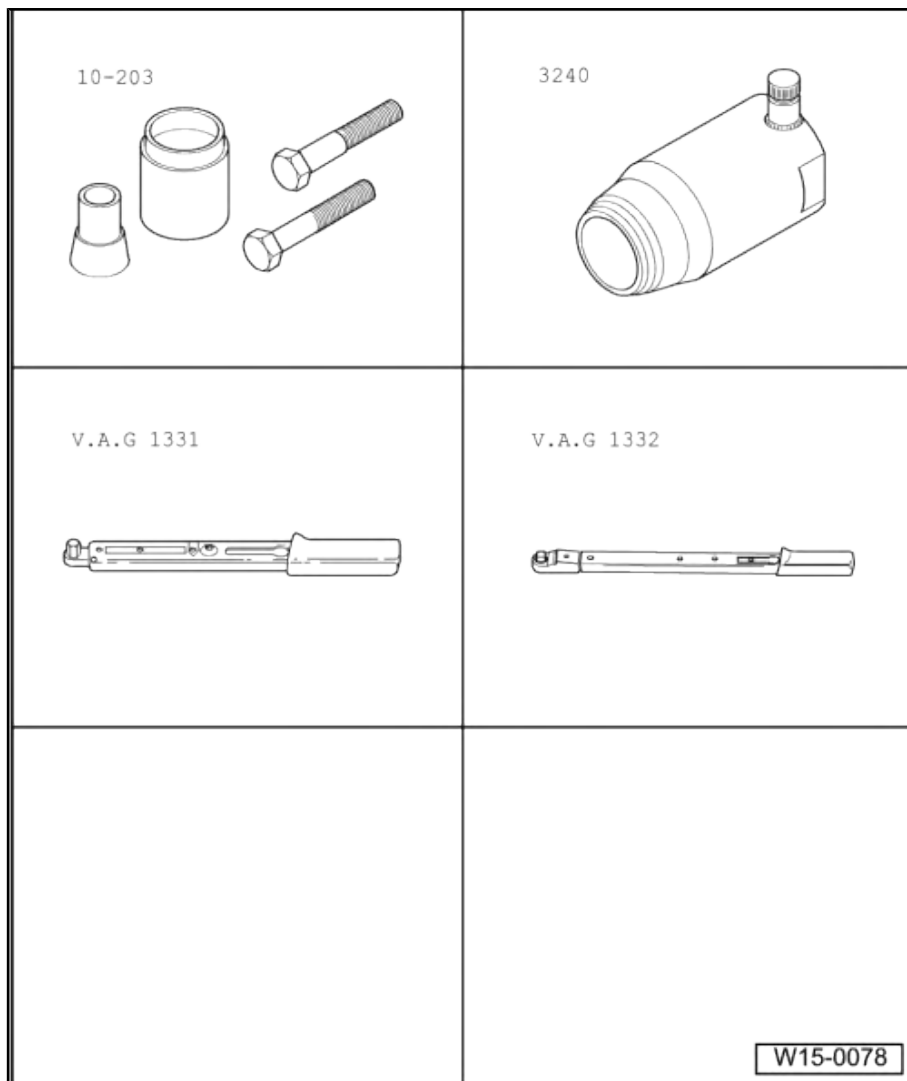




3.3 Removing and installing camshaft oil seal

Special tools and workshop equipment required

- ◆ Fitting tool - 10 - 203-
- ◆ Oil seal extractor - 3240-
- ◆ Torque wrench - V.A.G 1331-
- ◆ Torque wrench - V.A.G 1332-
- ◆ Bolt M12 x 1.5 x 65



Removing



Note

- ◆ *The toothed belt need not be removed completely.*
- ◆ *Once the crankshaft is locked it need only be removed from the camshaft pulley.*



- Remove camshaft sprocket and hub ⇒ [page 87](#) .
- Unscrew inner part of oil seal extractor - 3240- 2 turns (approx. 3 mm) from the outer part and lock in position with the knurled screw.
- Lubricate threaded head of oil seal extractor, place it in position and, exerting firm pressure, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part against camshaft until oil seal is pulled out.

Installing

Installation is carried out in the reverse order; note the following:



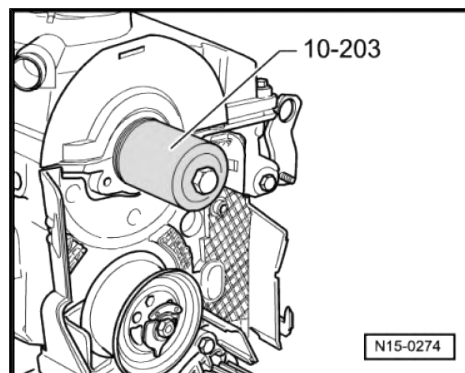
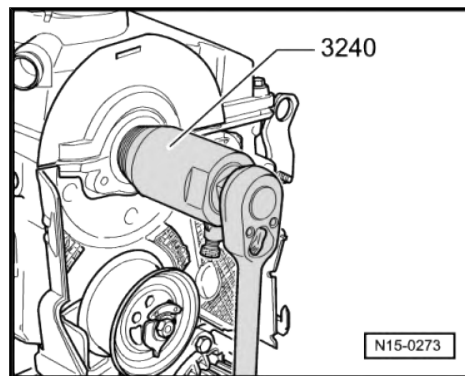
Note

The oil seal sealing lip must not be additionally oiled or greased.

- Remove oil residues from crankshaft journal with a clean cloth.
- Tape over groove in taper of camshaft (e.g. using Sellotape).
- Carefully place seal onto camshaft.
- Press in oil seal with press piece of fitting tool - 10 - 203- and bolt M12 × 1.5 x 65 as far as stop.
- Installing, tensioning toothed belt (for vehicles ► 12.05) ⇒ [page 65](#) .
- Installing, tensioning toothed belt (for vehicles 01.06 ►) ⇒ [page 73](#) .

Specified torques

- ◆ ⇒ [“2.1 Assembly overview - toothed belt drive”, page 64](#)
- ◆ ⇒ [“2.1 Assembly overview - assembly mountings”, page 14](#)

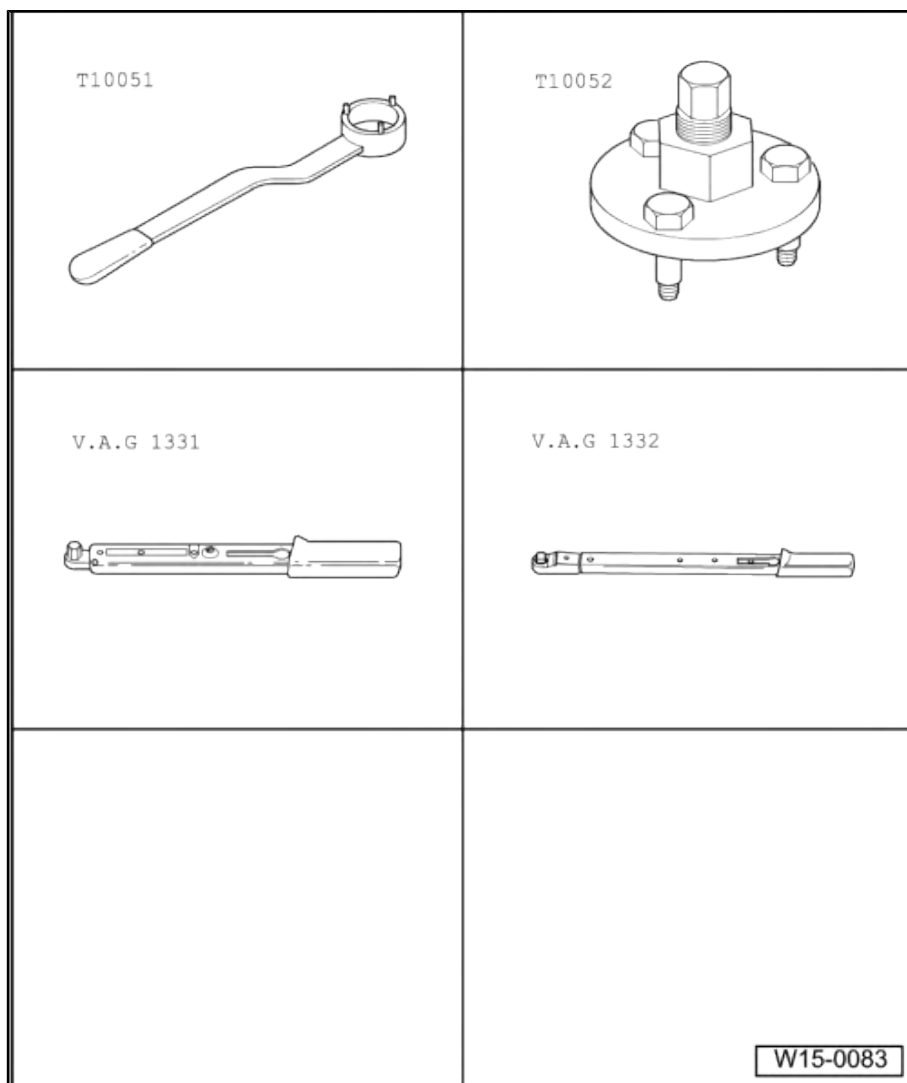




3.4 Removing and installing camshaft

Special tools and workshop equipment required

- ◆ Counterhold tool - T10051-
- ◆ Puller - T10052-
- ◆ Torque wrench - V.A.G 1331-
- ◆ Torque wrench - V.A.G 1332-
- ◆ Sealant ⇒ Electronic Parts Catalogue (ETKA)



Removing

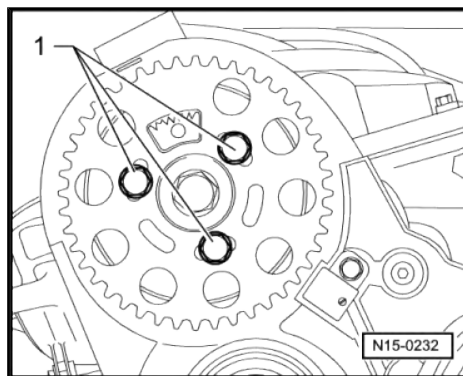


Note

- ◆ *The toothed belt need not be removed completely.*
- ◆ *Once the crankshaft is locked it need only be removed from the camshaft pulley.*
- Loosening toothed belt, (for vehicles ► 12.05) ⇒ [page 65](#) .
- Loosening toothed belt, (for vehicles 01.06 ►) ⇒ [page 73](#) .
- Remove locking pin - 3359- .



- Remove securing bolts -1- for camshaft pulley.
- Pull camshaft pulley off hub.



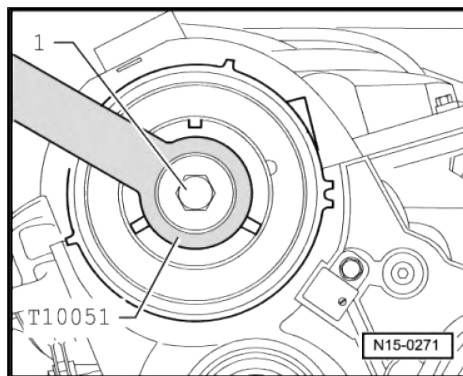
- Loosen hub securing bolt -1-.
- Use counterhold tool - T10051- to do this.



Note

Turn hub clockwise if the counterhold cannot be fitted.

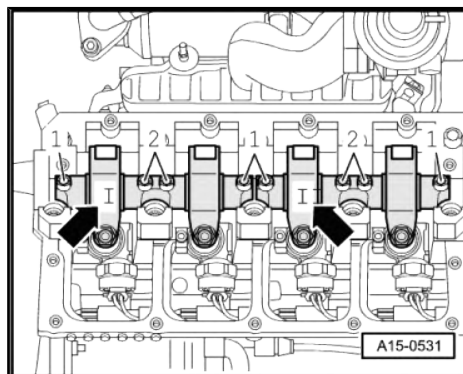
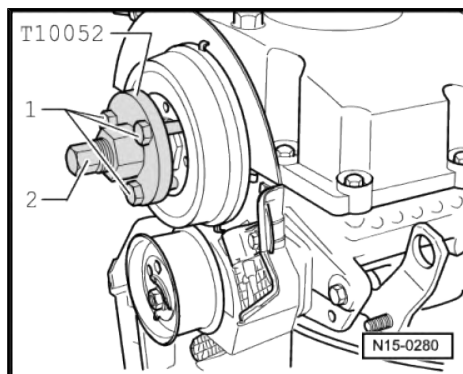
- Unscrew hub securing bolt approx. 2 turns.
- Position puller - T10052- and align with hub holes.
- Apply tension to hub by tightening puller evenly until hub separates from taper of camshaft.



Note

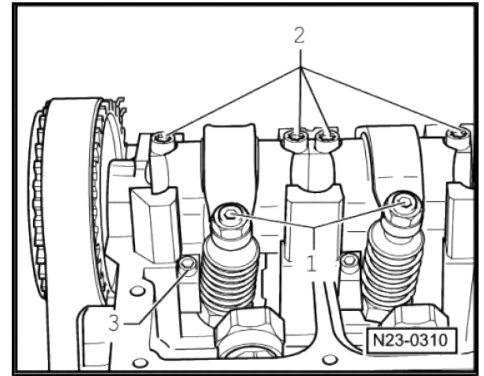
Hold puller with 30 mm spanner whilst doing this.

- Remove hub from taper of camshaft.
- Remove cylinder head cover ➔ [page 53](#) .
- Mark rocker arm shafts using a permanent felt tip marker to prevent interchanging -arrows-.





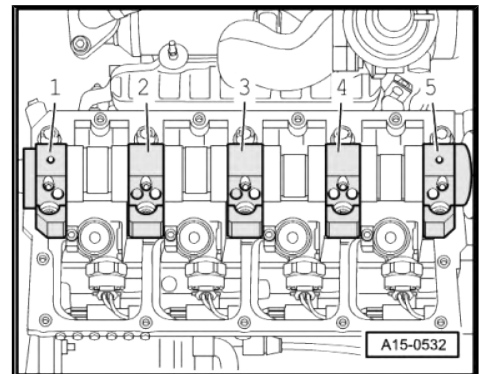
- Loosen lock nuts of adjustment screws -1- and remove adjustment screws.
- Loosen securing bolts -2- for rocker arm shaft working from outside to inside using Socket XZN 10 - 3410- . Remove rocker arm shaft.
- Remove vacuum pump ➔ [page 57](#) .



- First remove bearing caps 5, 1 and 3. Loosen bearing caps 2 and 4 alternately and diagonally.
- Remove camshaft.

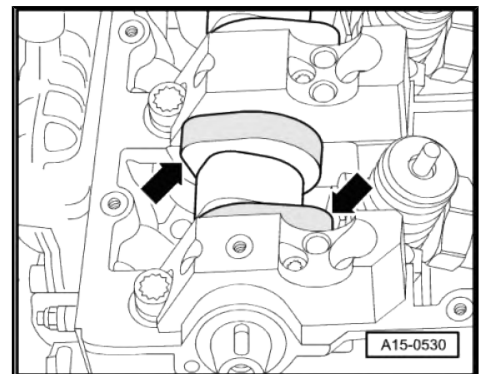
Installing

Installation is carried out in the reverse order; note the following:



Note

- ◆ When camshaft is installed, No. 1 cylinder cams must point upwards.
- ◆ Do not interchange used bearing shells (mark).
- ◆ When installing the camshaft, ensure proper seating of retaining lugs in bearing caps and cylinder head.
- ◆ Before installing bearing caps, ensure that cylinder head bolt washers are inserted in the cylinder head.

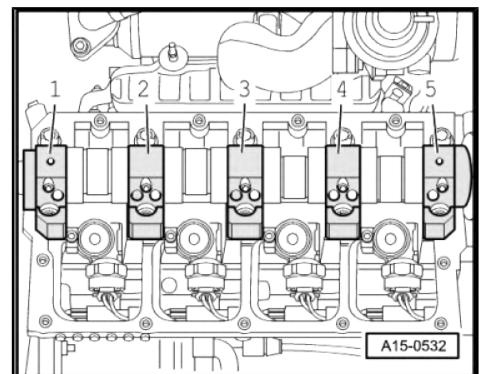


- Oil running surfaces of bearing shells.
- Install bearing caps 2 and 4 using new bolts.
- Tighten bearing caps 2 and 4 using alternate and diagonal sequence.
- Install bearing caps 5, 1 and 3 using new bolts.



Note

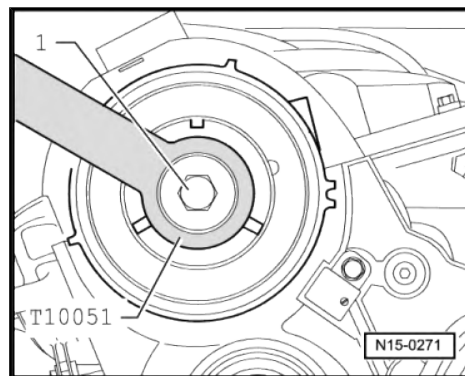
- ◆ Seal parting surfaces of bearing caps 1 and 5 with sealant as per ➔ *Electronic Parts Catalogue (ETKA)* .
- ◆ Bearing cap 5 must be flush with outer edge of cylinder head, otherwise leaks can occur at the vacuum pump.



- Tighten bearing caps 5, 1, and 3 also.
- Install camshaft seal ➔ [page 85](#) .
- Fit hub on camshaft.



- Tighten securing bolt -1- of hub.
- Use counterhold - T10051- to do this.



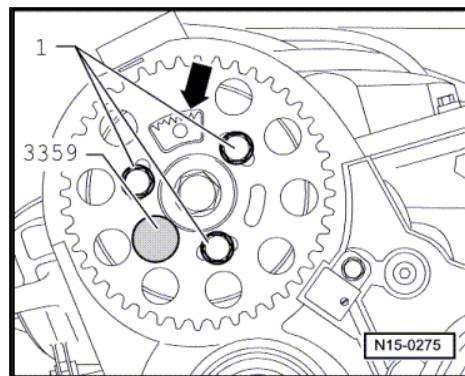
- Push camshaft sprocket onto hub.



Note

The toothed segment -arrow- of the camshaft belt pulley must be on top.

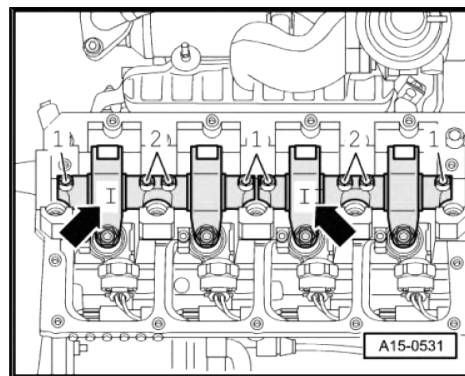
- Align camshaft pulley at centre of elongated holes.
- Insert securing bolts -1- by hand without play to camshaft sprocket.
- Lock hub with diesel injection pump locking pin - 3359- .
- Installing, tensioning toothed belt (for vehicles ► 12.05)
⇒ [page 65](#) .
- Installing, tensioning toothed belt (for vehicles 01.06 ►)
⇒ [page 73](#) .
- Renew unit injector ball studs ⇒ [Item 5 \(page 143\)](#) .



Note

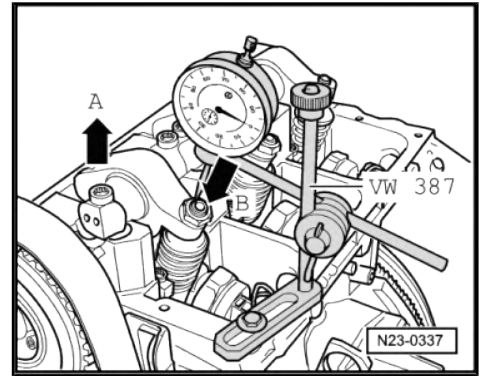
Each time the rocker arm shaft is removed and each time work is performed which requires adjustment of the unit injector, the adjustment screws ⇒ [Item 4 \(page 143\)](#) and the ball pins ⇒ [Item 5 \(page 143\)](#) of the unit injectors must be renewed.

- Fit rocker arm shafts with new adjustment screws and tighten new securing bolts as follows:
- First, tighten inner bolts -2-, and then outer bolts -1- evenly and diagonally.

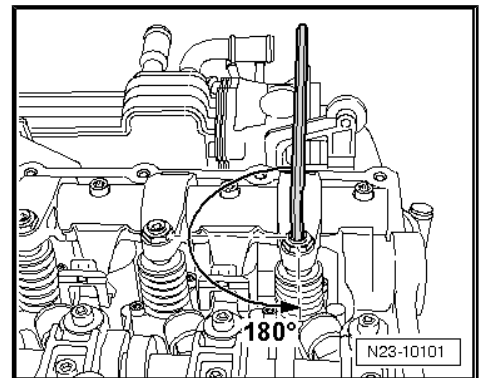




- Fit dial gauge onto adjustment screw of unit injector as shown.
- Turn crankshaft in direction of engine rotation until roller of rocker arm is located at tip of drive cam. Roller side -arrow A- positioned at highest point, dial gauge -arrow B- positioned at lowest point.
- Remove dial gauge.
- Now turn adjustment screw into rocker arm until significant resistance can be felt (unit injector is at limit stop).



- Slacken adjustment screw of stop by 180°.
- Hold adjuster bolt in this position and tighten lock nut.
- Install cylinder head cover ⇒ [page 53](#) .
- Install upper toothed belt guard.
- Install vacuum pump ⇒ [page 57](#) .



Note

When new bucket tappets have been installed the engine must not be started for about 30 minutes. The hydraulic compensation elements must settle (otherwise valves will strike pistons).

Specified torques

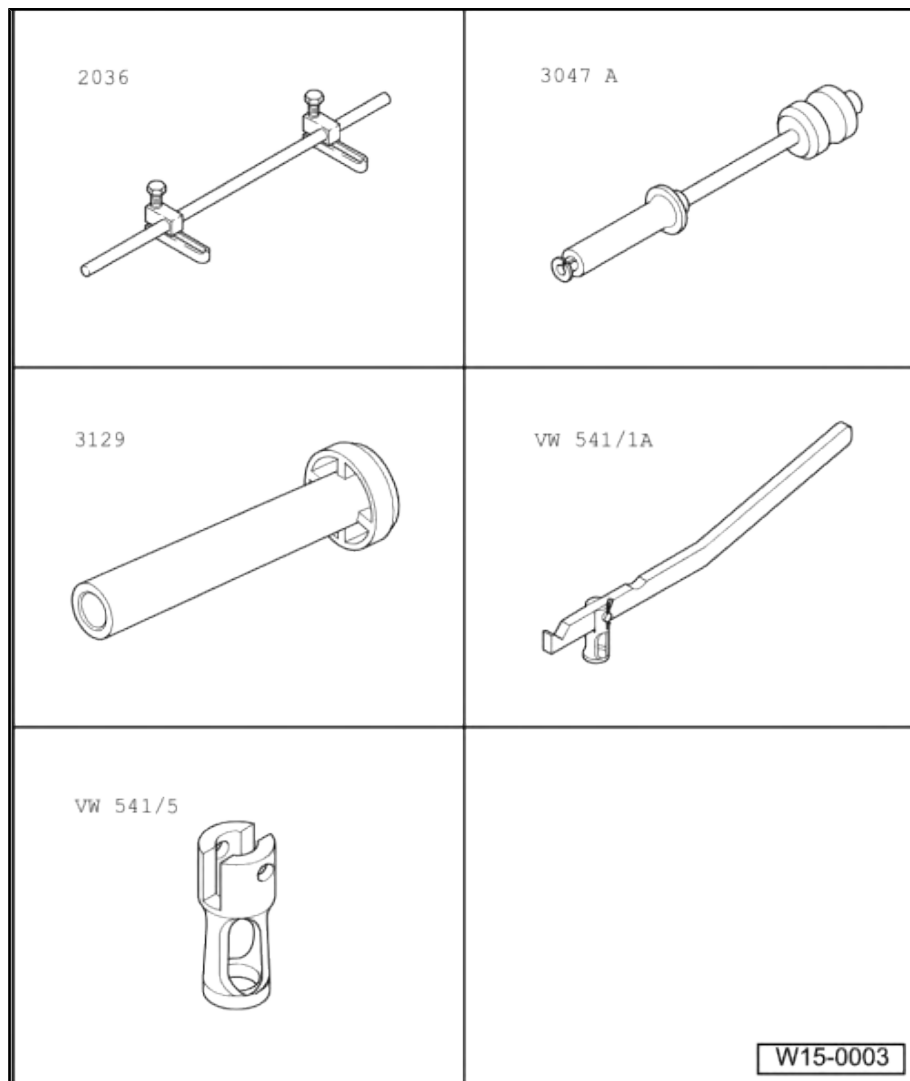
- ◆ ⇒ [“2.1 Assembly overview - toothed belt drive”, page 64](#)
- ◆ ⇒ [“2.1 Assembly overview - assembly mountings”, page 14](#)
- ◆ ⇒ [“1.1 Assembly overview - injectors”, page 143](#)



3.5 Removing and installing valve stem seal

Special tools and workshop equipment required

- ◆ Valve assembly device - 2036-
- ◆ Puller - 3047 A-
- ◆ Fitting tool - 3129-
- ◆ Valve lever - VW 541/1 A-
- ◆ Thrust piece for VW 541 / 1 A and 2037 - VW 541/5-



Removing

(With cylinder head installed)



Note

Cylinder heads with cracks between the valve seats may be used without reducing engine life, provided the cracks are small and not more than 0.5 mm wide.

- Remove camshaft ⇒ [page 87](#) .
- Remove tappets and place to one side with face downwards. When doing this, ensure that tappets are not interchanged.
- Set piston of respective cylinder to top dead centre (TDC).

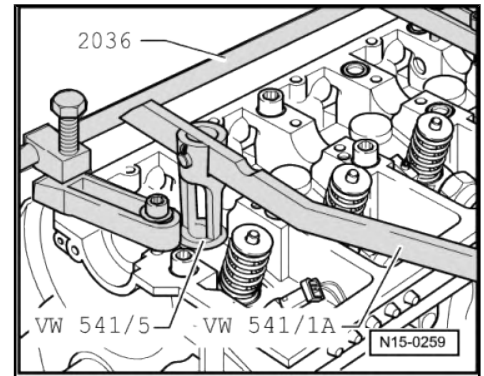


- Fit valve assembly tool - 2036- and adjust mountings to height of studs.
- Remove valve springs using valve lever - VW 541/1 A- and thrust piece for VW 541 / 1 A and 2037 - VW 541/5- .



Note

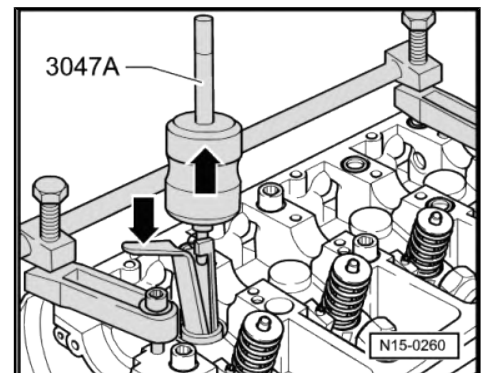
The valves are supported by the piston crown.



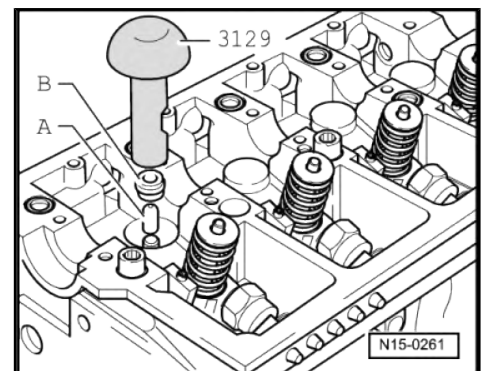
- Pull off valve stem seals using puller - 3047 A- .

Installing

Installation is carried out in the reverse order; note the following:



- Place the plastic sleeve -A- supplied on the respective valve stem. This will prevent the new valve stem seal -B- being damaged.
- Place new valve stem seal in fitting tool - 3129- .
- Oil valve stem seal sealing lip and press carefully onto the valve guide.



Specified torques

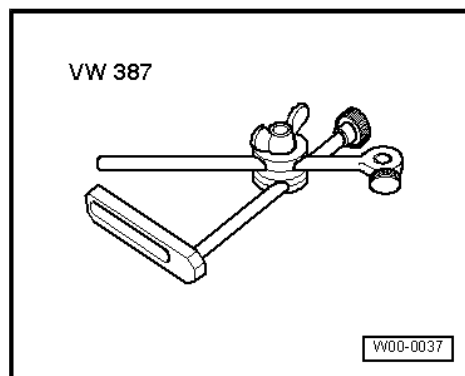
- ◆ ⇒ [“2.1 Assembly overview - toothed belt drive”, page 64](#)
- ◆ ⇒ [“2.1 Assembly overview - assembly mountings”, page 14](#)
- ◆ ⇒ [“1.1 Assembly overview - injectors”, page 143](#)



4 Inlet and exhaust valves

⇒ ["4.1 Checking valve guides", page 94](#)

4.1 Checking valve guides

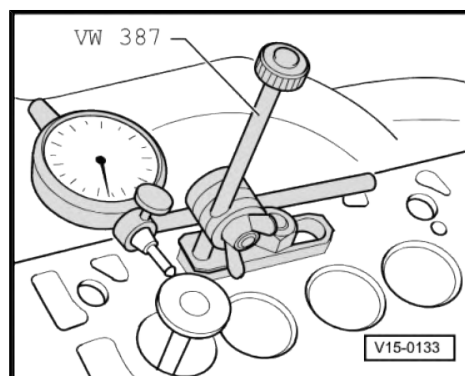


Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-
- ◆ Dial gauge

Test procedure

- Insert new valve in guide. The end of the valve stem must be flush with the guide. On account of differing stem diameters, only use inlet valve in inlet guide and exhaust valve in exhaust guide.
- Determine rock. Wear limit: max. 1.3 mm
- Cylinder head must be renewed if rock exceeds wear limit.





17 – Lubrication

1 Sump, oil pump

⇒ [“1.1 Assembly overview - sump and oil pump”, page 95](#)

⇒ [“1.2 Removing and installing oil sump”, page 96](#)

⇒ [“1.3 Engine oil”, page 99](#)

1.1 Assembly overview - sump and oil pump

1 - Bolt

- ☐ 15 Nm

2 - Nut

- ☐ 25 Nm

3 - Bracket

- ☐ Attached to cylinder block

4 - Dipstick

- ☐ The oil level must not be above the max. mark!
- ☐ Markings ⇒ [page 99](#).

5 - Guide tube

- ☐ with funnel
- ☐ Secured to oil filter bracket.

6 - Bolt

- ☐ 10 Nm

7 - Dowel sleeves

8 - O-ring

- ☐ Renew after removing.

9 - Bolt

- ☐ 15 Nm

10 - Suction line

- ☐ Clean strainer if soiled.

11 - Baffle plate

12 - Bolt

- ☐ 15 Nm

13 - Bolt

- ☐ 15 Nm

14 - Oil sump

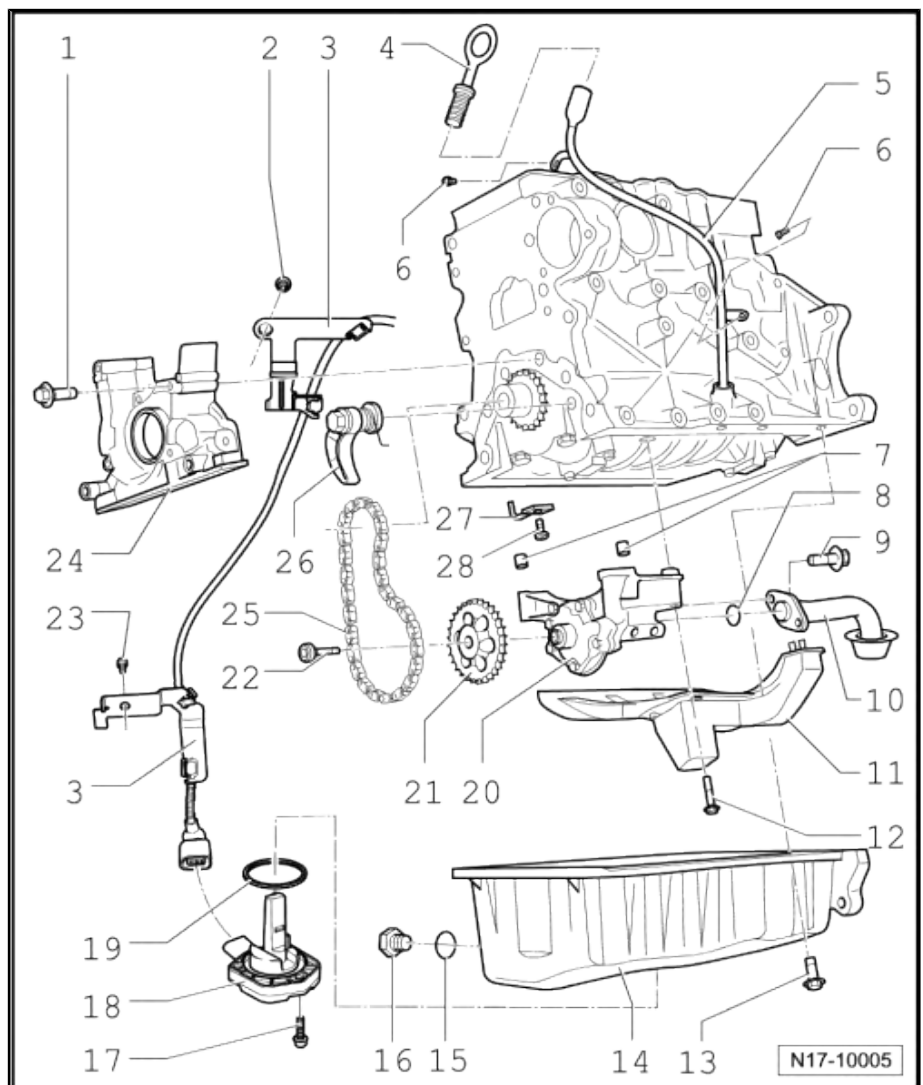
- ☐ Clean sealing surface before fitting.
- ☐ Seal with Silicone sealant ⇒ [Electronic Parts Catalogue \(ETKA\)](#)
- ☐ Removing and installing ⇒ [page 96](#).

15 - Seal

- ☐ Renew after removing.

16 - Oil drain plug

- ☐ Renew plug with attached seal.





- ☐ 30 Nm

17 - Bolt

- ☐ 10 Nm

18 - Oil level and oil temperature sender - G266-

- ☐ Not installed on all engines.

19 - Seal

- ☐ Renew after removing.

20 - Oil pump

- ☐ With 12 bar pressure relief valve.
- ☐ Before installing, check that both dowel sleeves for centring oil pump on cylinder block are fitted.
- ☐ Renew if running surfaces and gears are scored.

21 - Chain sprocket for oil pump

22 - Bolt

- ☐ 25 Nm

23 - Bolt

- ☐ 15 Nm

24 - Sealing flange

- ☐ With seal.
- ☐ Must seat on dowel sleeves.
- ☐ Do not additionally oil or grease the oil seal sealing lip.
- ☐ Before installing, remove oil residue from crankshaft journal using a clean cloth.
- ☐ Insert with silicone sealant → Electronic Parts Catalogue (ETKA) .
- ☐ Renewing crankshaft oil seal - belt pulley end ⇒ [page 20](#)
- ☐ Removing and installing ⇒ [page 22](#) .

25 - Chain

26 - Chain tensioner with tensioning plate

- ☐ When installing, pretension spring and fit.
- ☐ 15 Nm

27 - Oil spray jet

- ☐ For piston cooling.

28 - Bolt

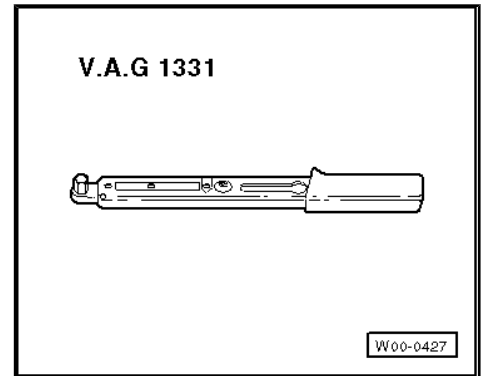
- ☐ Insert without sealant.
- ☐ 25 Nm

1.2 Removing and installing oil sump

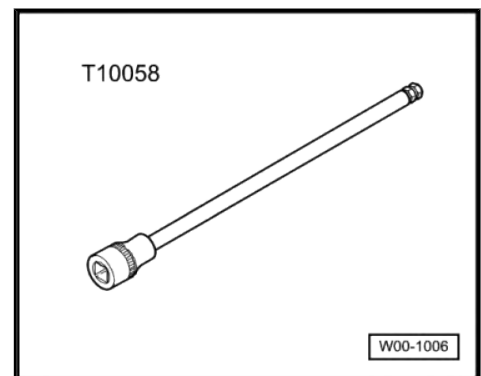
Special tools and workshop equipment required



- ◆ Torque wrench - V.A.G 1331-



- ◆ Allen key, long reach 5 mm - T10058-



- ◆ Silicone sealant ⇒ Electronic Parts Catalogue (ETKA)
- ◆ Flat scraper
- ◆ Hand drill with plastic brush attachment
- ◆ Eye protection

Removing

- Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Body, front; Noise insulation .
- Drain off engine oil.



Note

Observe environmental regulations for disposal.

- Detach connector from oil level and oil temperature sender - G266- , if fitted. Unclip line from sump.
- Unbolt sump using special wrench, long reach - T10058- .
- Loosen sump with light blows of a rubber headed hammer if necessary.
- Remove sealant residues from cylinder block with a flat scraper .



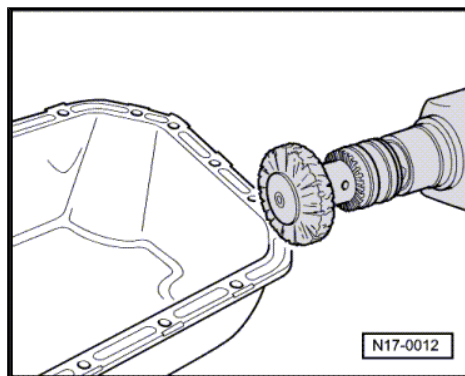
- Remove sealant residues on sump with rotating brush, e.g. hand drill with plastic brush insert (wear safety goggles).
- Clean sealing surfaces. They must be free of oil and grease.

Installing

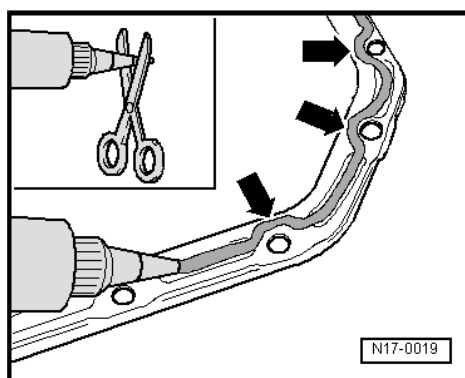


Note

- ◆ *Observe use-by-date of sealant.*
- ◆ *The sump must be installed within 5 minutes of applying silicone sealing compound.*
- ◆ *The sealant bead must not be thicker, otherwise excess sealing compound will enter the oil sump and may block the oil suction line strainer.*



- Cut off nozzle on tube of silicone sealant ⇒ Electronic Parts Catalogue (ETKA), at front marking (Ø of nozzle approx. 3 mm).
- Apply silicone sealant ⇒ Electronic Parts Catalogue (ETKA) to clean sealing surface of sump, as shown. Sealant bead must
 - ◆ be 2...3 mm thick.
 - ◆ run along inner side of bolt holes -arrows-.

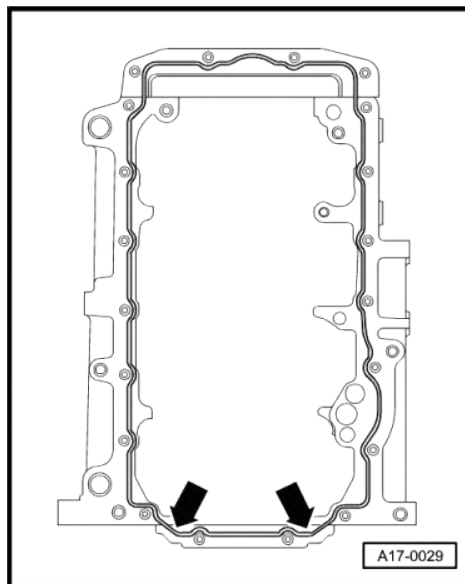


- Apply silicone sealant ⇒ Electronic Parts Catalogue (ETKA) to clean sealing surface of sump, as shown in figure. (The figure shows the position of the sealant bead on the cylinder block.)
- Immediately position sump and tighten all sump bolts slightly. Ensure that sump is flush against intermediate plate and gearbox flange.



Note

- ◆ *The sump must be flush with cylinder block.*
- ◆ *Let sealing compound dry for approx. 30 minutes after installing oil sump. Only then fill with engine oil.*
- Tighten sump bolts in diagonal sequence.
- Tighten sump bolts at gearbox end using special wrench, long reach - T10058- .
- Tighten bolts between sump and gearbox.



Specified torques

- ◆ ⇒ [“1.1 Assembly overview - sump and oil pump”, page 95](#)



1.3 Engine oil



Note

- ◆ *The oil level must not be above the max. mark - danger of damage to catalytic converter!*
- ◆ *Finding metal shavings or a large quantity of small metal particles during engine repair could indicate that the crankshaft bearings or conrod bearings are damaged. To prevent this from causing further damage, perform the following repairs:*
- ◆ *Thoroughly clean oil channels.*
- ◆ *Renew oil spray jets.*
- ◆ *Renew engine oil cooler.*
- ◆ *Renew oil filter element.*

Oil capacities:

Engine codes AXB and AXC

With oil filter 5.8 l

1) Top up to max. mark as necessary.

Engine codes BRR and BRS

With oil filter 6.3 l

Engine oil specifications:

⇒ Maintenance ; Booklet 19

Markings on oil dipstick

Old version

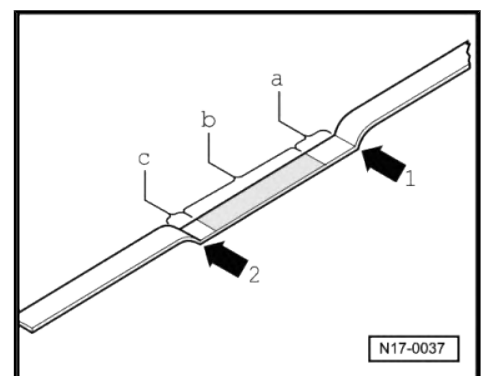
1 - Max. mark

2 - Min. mark

a - Oil level in max. mark area: Do not replenish engine oil!

b - Oil level in middle range: Can be replenished with engine oil.

c - Oil level in min. mark area: Replenish with max 0.5 l engine oil!



New version

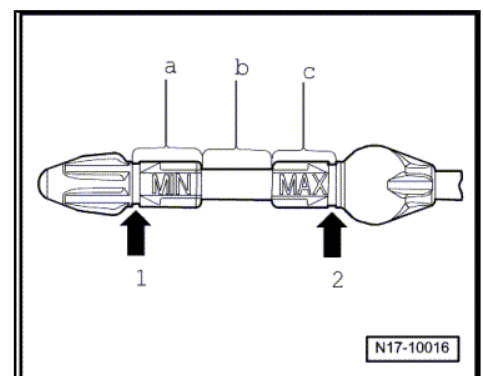
1 - Min. mark

2 - Max. mark

a - Oil level in min. mark area: Replenish with approx. 0.5 l engine oil!

b - Oil level in middle range: Can be replenished with engine oil.

c - Oil level in max. mark area: Do not replenish engine oil!





2 Oil filter, oil pressure switch

⇒ ["2.1 Assembly overview - oil filter housing, oil pressure switch", page 100](#)

⇒ ["2.2 Checking oil pressure and oil pressure switch", page 101](#)

⇒ ["2.3 Measure oil consumption", page 102](#)

2.1 Assembly overview - oil filter housing, oil pressure switch

1 - Oil filter bracket

2 - Bolt

- ☐ Renew after removing.
- ☐ First fit upper left and lower right bolts and then tighten all 4 bolts in diagonal sequence.
- ☐ 15 Nm + 90°

3 - Gasket

- ☐ Renew after removing.

4 - Seal

- ☐ Renew after removing.

5 - Union

- ☐ 35 Nm

6 - Oil supply line

- ☐ To turbocharger.
- ☐ Removing and installing
⇒ [page 103](#) .

7 - Cap

- ☐ Loosen and tighten with 36 mm socket - T10125- .
- ☐ 25 Nm

8 - O-ring

- ☐ Renew after removing.

9 - Oil filter element

- ☐ Ensure "Top" is uppermost when fitting

10 - Oil pressure switch - F1-

- ☐ 0.7 bar switch: brown or 0.9 bar switch: grey
- ☐ If seal is leaking, nip open and renew.
- ☐ Checking ⇒ [page 101](#) .

11 - Plug

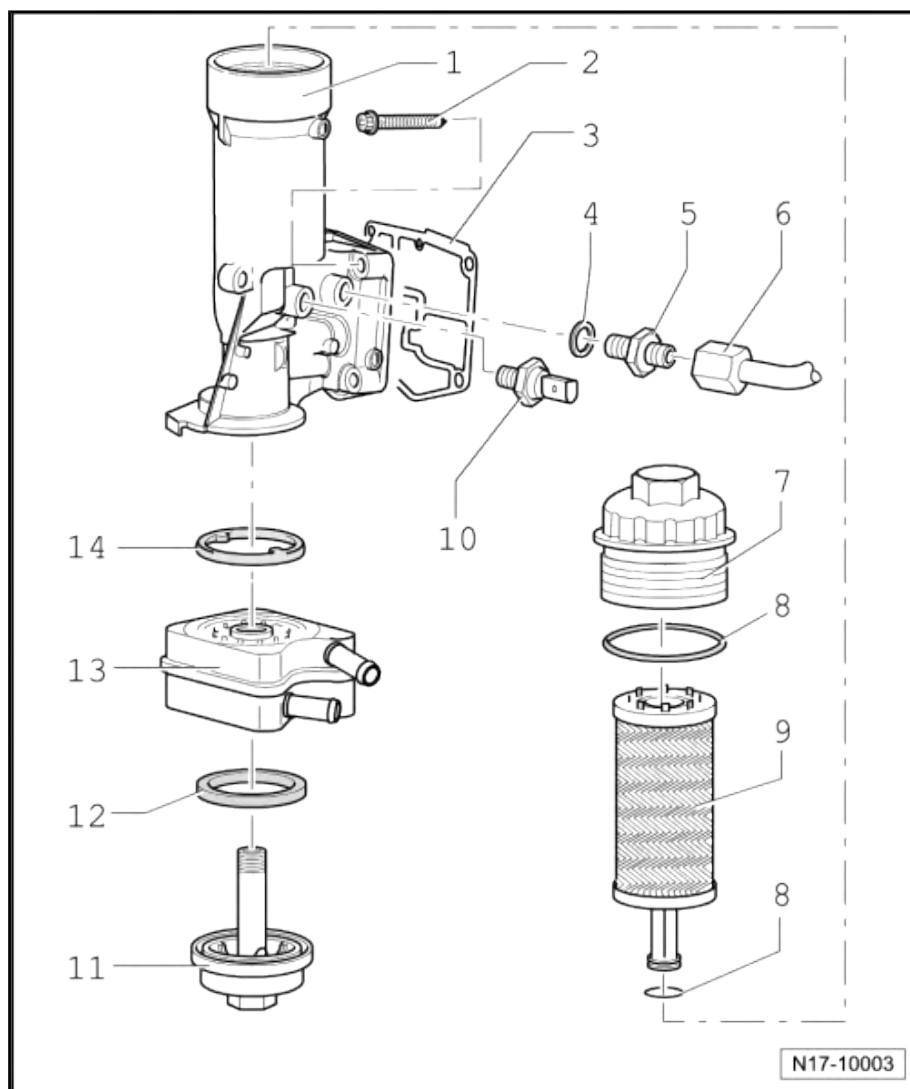
- ☐ 25 Nm

12 - Gasket

- ☐ Renew after removing.

13 - Engine oil cooler

- ☐ Ensure clearance to adjacent components.
- ☐ See note ⇒ [page 95](#) .





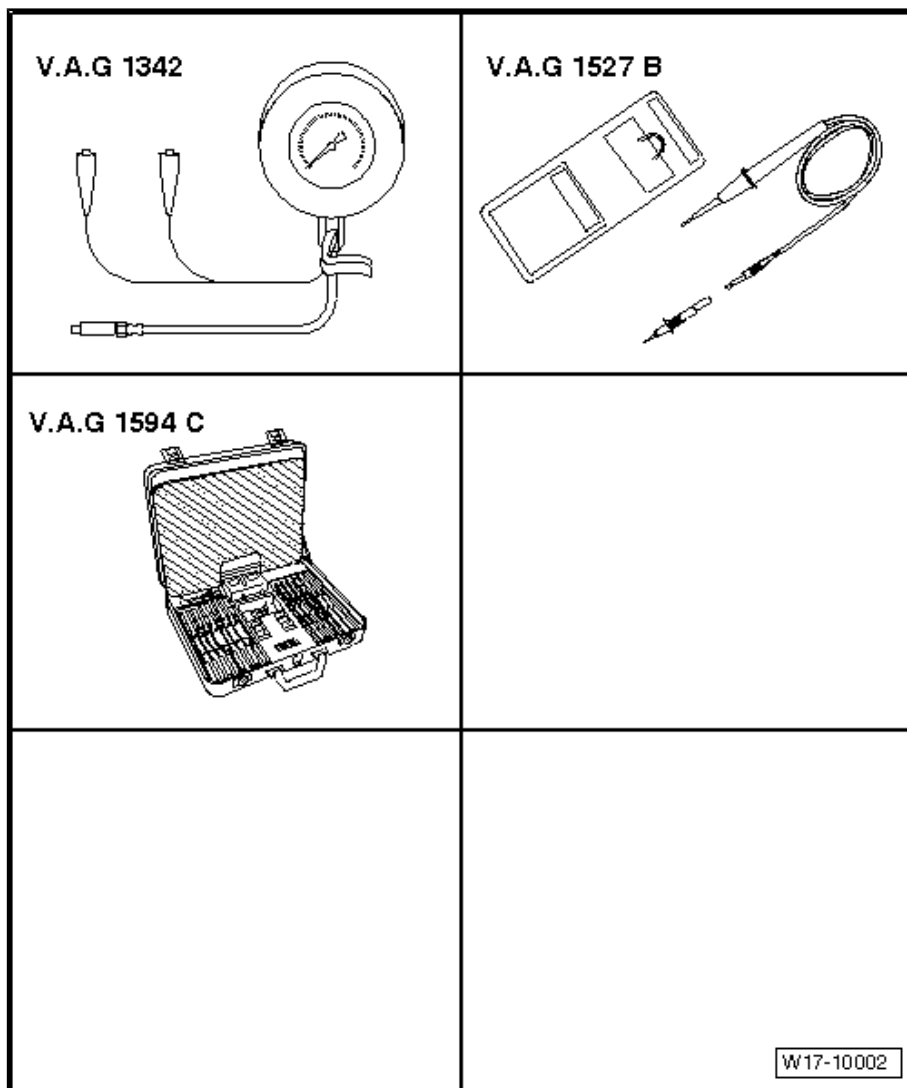
14 - Seal

- ☐ Renew after removing.

2.2 Checking oil pressure and oil pressure switch

Special tools and workshop equipment required

- ◆ Oil pressure tester - V.A.G 1342-
- ◆ Voltage tester - V.A.G 1527 B-
- ◆ Auxiliary measuring set - V.A.G 1594C-



Test procedure



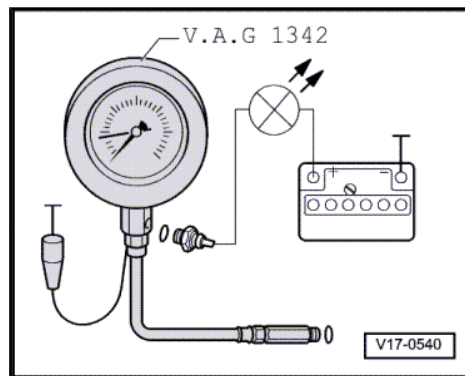
Note

Functional check and repair of the optical and acoustic oil pressure gauge: current flow diagrams ⇒ Vehicle diagnostic tester.



- Remove oil pressure switch - F1- and screw into tester.
- Screw tester into oil filter bracket in place of oil pressure switch.
- Connect brown wire of tester to earth (-).
- Connect voltage tester - V.A.G 1527 B- to battery positive (+) and oil pressure switch using cables from auxiliary measuring set - V.A.G 1594C- . LED must not light up.
- Start engine and increase revolutions slowly.
- At 0.55...0.85 bar the LED must light up, otherwise renew oil pressure switch.
- Increase engine speed further. At 2,000 rpm and an oil temperature of 80°C the oil pressure should be at least 2.0 bar.

At higher engine speed, oil pressure must not exceed 7.0 bar. If necessary renew oil filter bracket.



2.3 Measure oil consumption

Special tools and workshop equipment required

- ◆ Vehicle diagnosis tester

Procedure

- Pull handbrake on.
- Manual gearbox: gear stick in neutral.
- Automatic gearbox: move selector lever to position "N".
- Connect ⇒ Vehicle diagnostic tester.
- Switch ignition on.
- Choose program Oil consumption measurement using ⇒ Vehicle diagnostic tester and follow instructions.



3 Oil circuit

⇒ ["3.1 Assembly overview - oil supply line", page 103](#)

⇒ ["3.2 Removing and installing oil supply line", page 103](#)

3.1 Assembly overview - oil supply line

1 - Bracket

2 - Retaining clamp

3 - Oil supply line

- ☐ To turbocharger.
- ☐ Removing and installing
⇒ [page 103](#) .

4 - Union nut

- ☐ 22 Nm

5 - Bolt

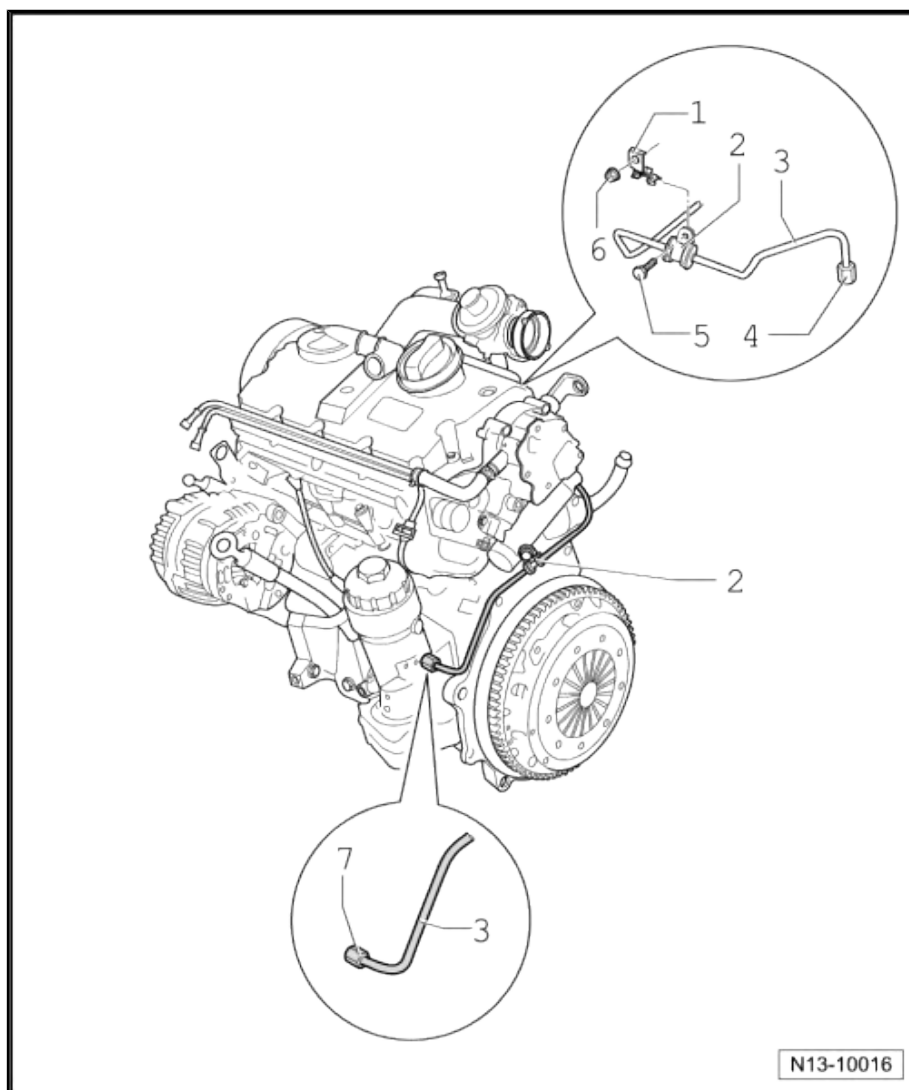
- ☐ 10 Nm

6 - Nut

- ☐ 25 Nm

7 - Union nut

- ☐ 22 Nm

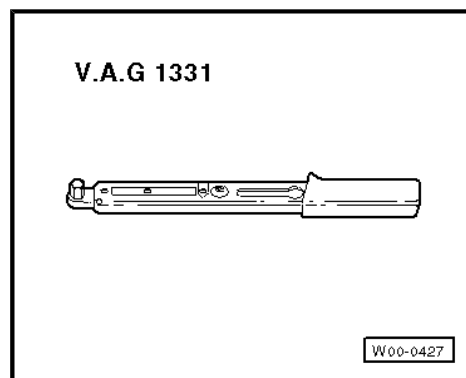


3.2 Removing and installing oil supply line

Special tools and workshop equipment required



- ◆ Torque wrench - V.A.G 1331-



Removing

- Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Body, front; Noise insulation .
- Unscrew securing bolts of retaining clip for oil supply line
⇒ [Item 5 \(page 103\)](#) .
- Unscrew union nuts of oil supply line on oil filter bracket
⇒ [Item 7 \(page 103\)](#) and exhaust turbocharger
⇒ [Item 1 \(page 133\)](#) or ⇒ [Item 3 \(page 135\)](#) .
- Remove oil supply line.

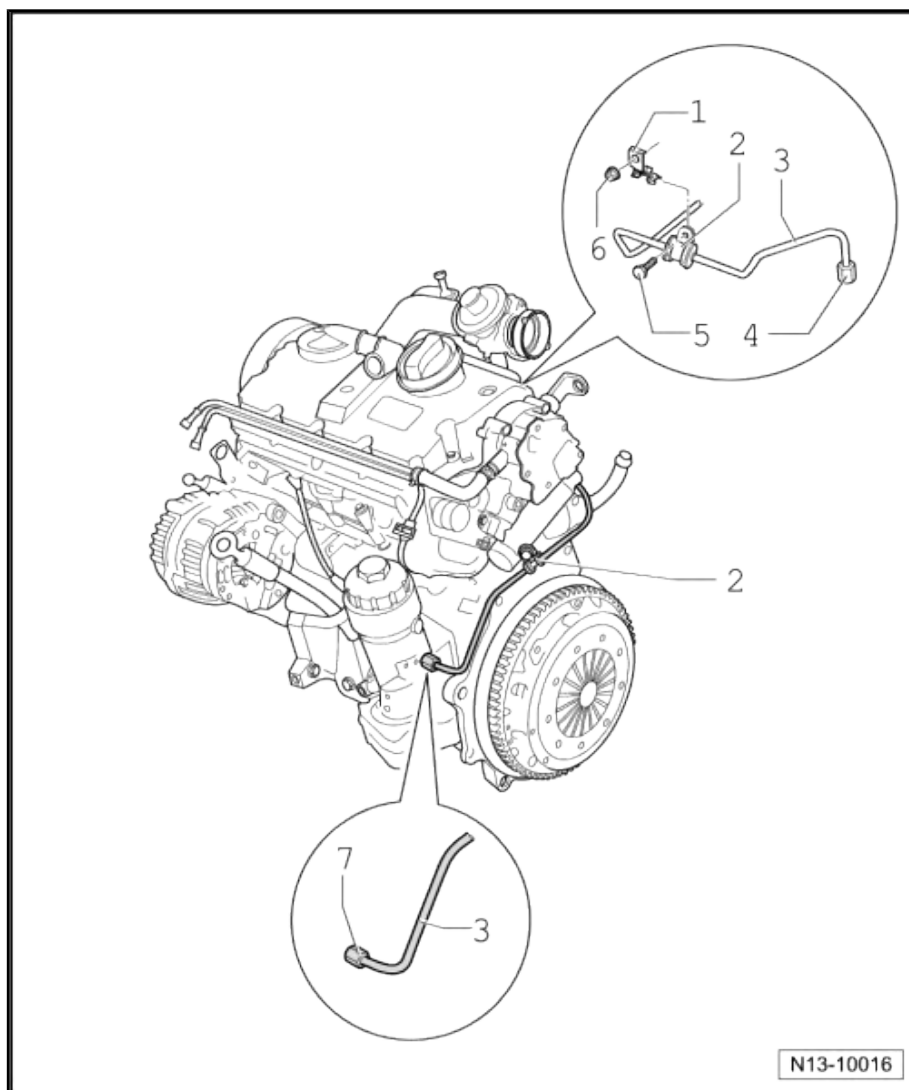
Installing

Installation is carried out in the reverse order; note the following:



Note

The procedure must be adhered to to ensure that the oil supply line is installed tension-free.



- Loosen securing bolts -6- of bracket -1-.
- Locate union nuts of oil supply line on connections.
- Hand-tighten union nut -7- on oil filter bracket.
- Hand-tighten union nut -4- on turbocharger.
- First tighten union nut -7- on oil filter bracket and then union nut -4- on turbocharger.

Specified torques

- ◆ ⇒ ["3.1 Assembly overview - oil supply line", page 103](#)



19 – Cooling

1 Cooling system, coolant

⇒ “1.1 Coolant hose schematic diagram - engine codes AXB and AXC”, page 106

⇒ “1.2 Coolant hose schematic diagram - engine codes BRR and BRS”, page 107

⇒ “1.3 Draining and filling coolant”, page 108

⇒ “1.4 Checking cooling system for leaks”, page 111

1.1 Coolant hose schematic diagram - engine codes AXB and AXC

1 - Heat exchanger for heater unit

2 - 2nd heat exchanger for heater unit

- ☐ Only if fitted with optional equipment.

3 - Supplementary water heater (auxiliary heater or preheater)

- ☐ Depending on equipment.

4 - Circulation pump - V55-

5 - Coolant expansion tank

6 - Engine oil cooler

7 - Radiator/cooler

8 - Coolant pump

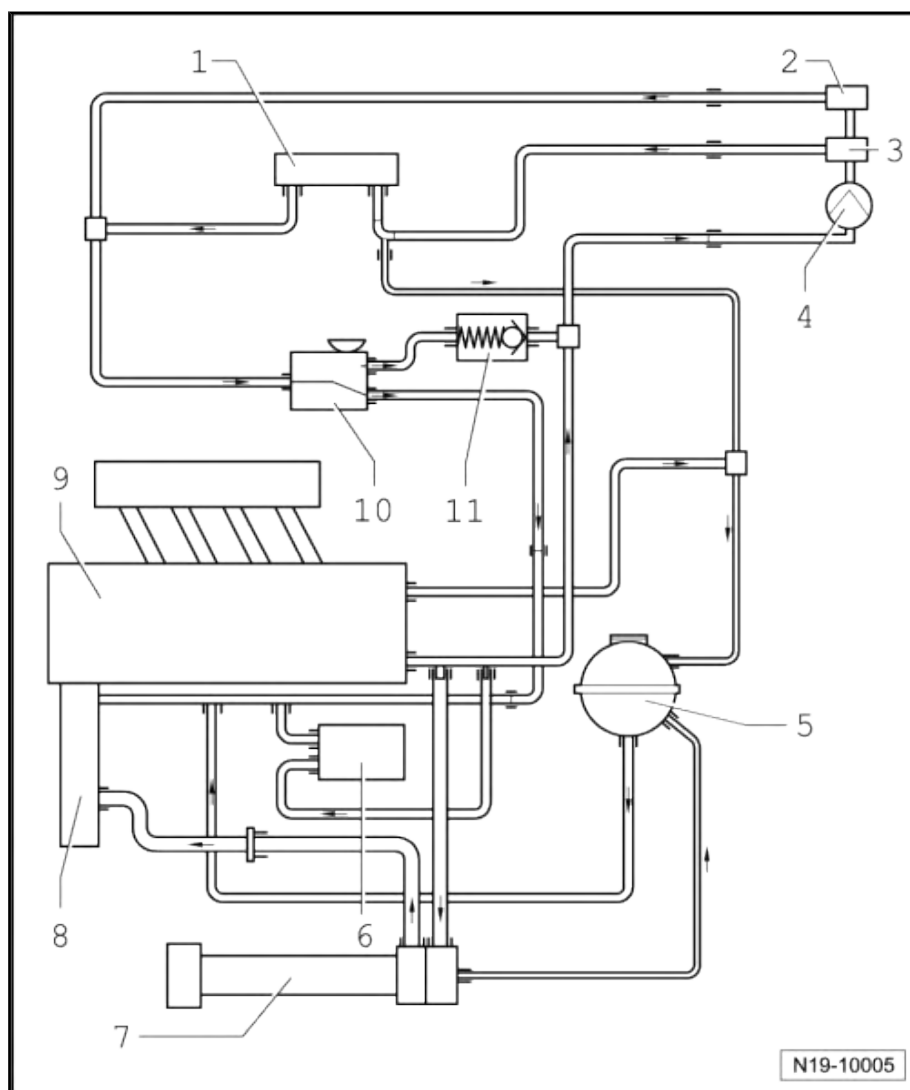
9 - Cylinder head/cylinder block

10 - Heater coolant shut-off valve - N279-

- ☐ Only with auxiliary coolant heater.

11 - Non-return valve

- ☐ Only with auxiliary coolant heater.
- ☐ Note installation position.





1.2 Coolant hose schematic diagram - engine codes BRR and BRS

1 - Heat exchanger for heater unit

2 - 2nd heat exchanger for heater unit

- ☐ Only if fitted with optional equipment.

3 - Supplementary water heater (auxiliary heater or preheater)

- ☐ Depending on equipment.

4 - Circulation pump - V55-

5 - Coolant expansion tank

6 - Engine oil cooler

7 - Radiator/cooler

8 - Coolant pump

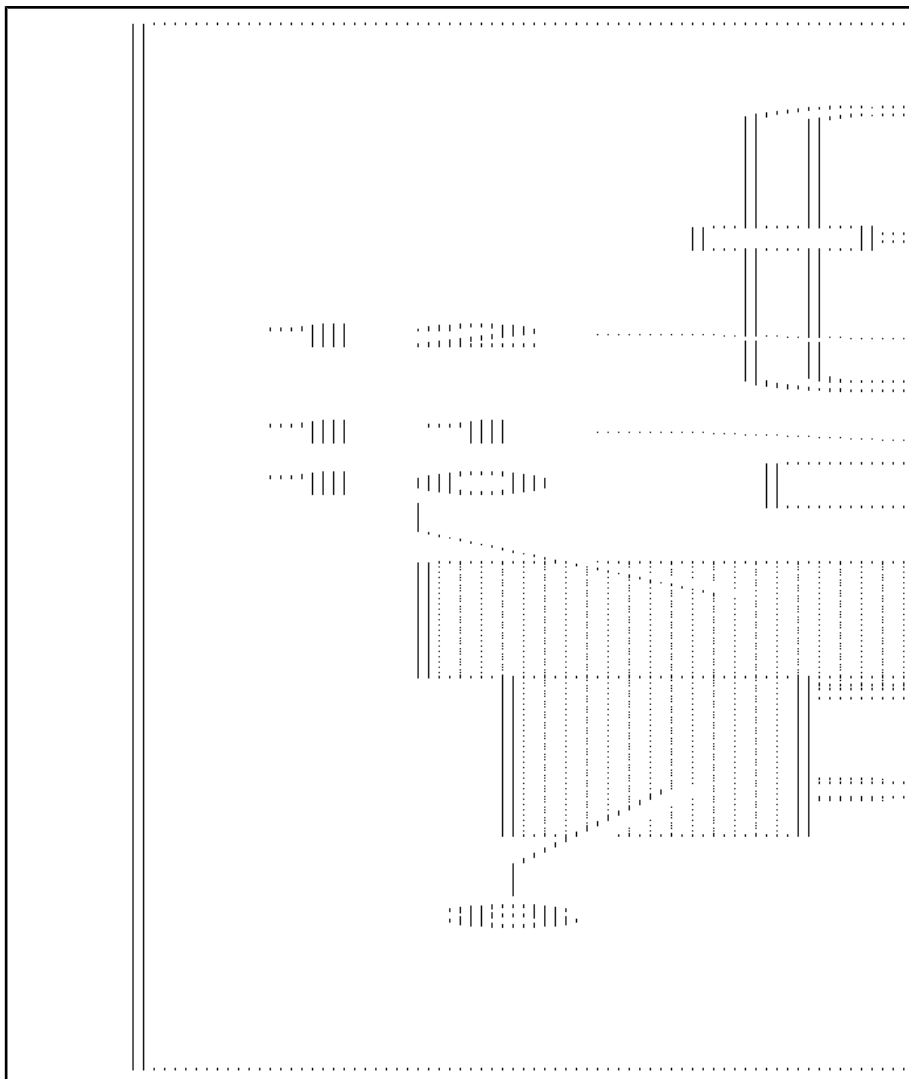
9 - Cylinder block

10 - Cylinder head

11 - Exhaust gas recirculation cooler

12 - Heater coolant shut-off valve - N279-

- ☐ Only with auxiliary coolant heater.



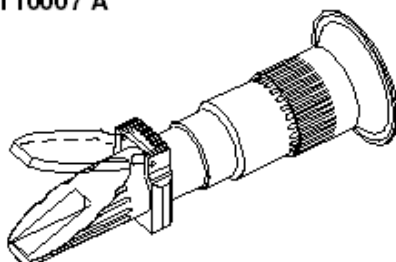


1.3 Draining and filling coolant

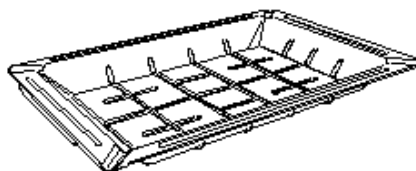
Special tools and workshop equipment required

- ◆ Refractometer - T10007 A-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - VAS 6340-
- ◆ Cooling system charge unit - VAS 6096-
- ◆ Adapter for cooling system tester - V.A.G 1274/8-

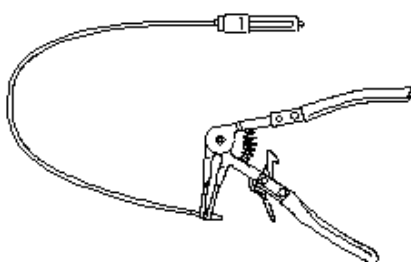
T10007 A



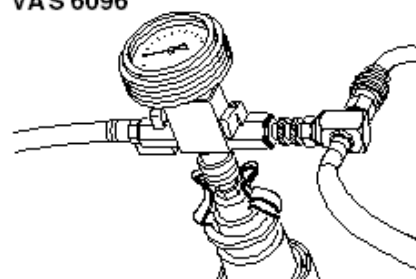
VAS 6208



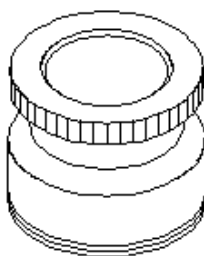
VAS 6340



VAS 6096



V.A.G 1274/8



W19-10042

Draining



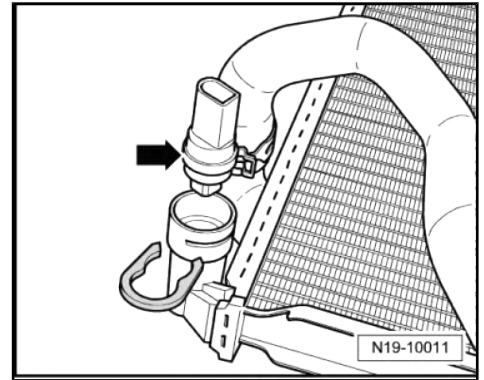
WARNING

Steam may escape when expansion tank is opened. Wear eye protection and protective clothing to avoid eye injuries and scalding. Cover cap with cloth and open carefully.

- Open filler cap on coolant expansion tank.
- Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Body, front; Noise insulation .



- Remove radiator outlet coolant temperature sender - G83-arrow-. To do this, pull retaining clip out of radiator flange.



- In addition to draining coolant from engine, pull the coolant hose off the engine oil cooler -arrow-.



Note

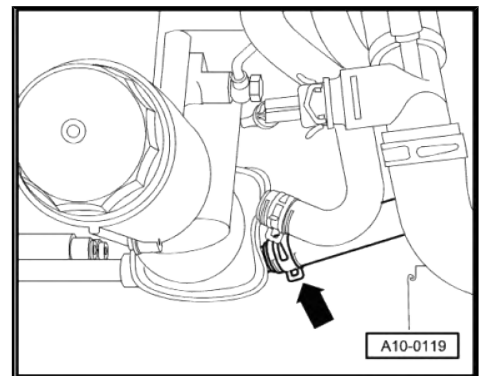
Observe environmental regulations for disposal.

Filling



Note

The amount of water used in the coolant mixture has a great influence on its effectiveness. Because the water quality differs from country to country and even region to region, Volkswagen has decided to define the quality of the water to be used in the coolant system. Distilled water fulfils all requirements. It is therefore recommended that the coolant be mixed with distilled water whenever the coolant is replenished or replaced, even for older models.



Caution

Only distilled water may be used for mixing with coolant additives. The use of distilled water ensures optimum protection against corrosion.



Note

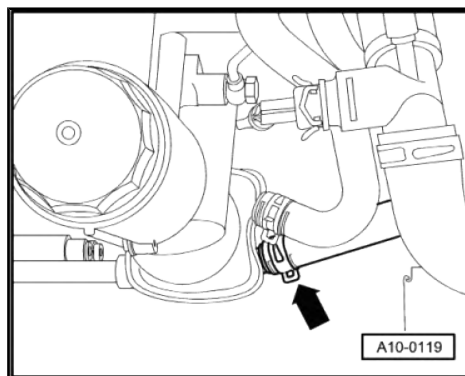
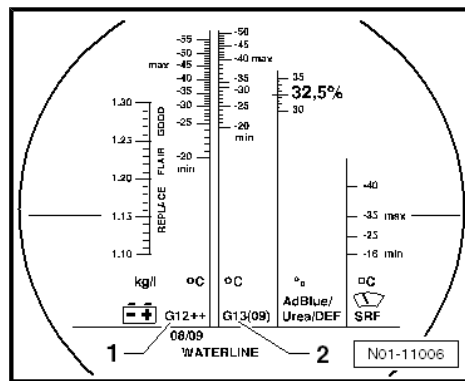
- ◆ Use only coolant additives which conform with the ⇒ *Electronic Parts Catalogue (ETKA)*. Other coolant additives may reduce corrosion protection substantially. The resulting damage could lead to loss of coolant and subsequent severe damage to the engine.
- ◆ The correct coolant solution ratio helps prevent damage due to freezing and corrosion as well as scaling. Moreover, the boiling temperature is raised. Therefore, the cooling system must be filled all year round with coolant additive.
- ◆ Because of its higher boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.
- ◆ Frost protection must be guaranteed down to about -25 °C (in countries with Arctic climates, down to about -36 °C).
- ◆ The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The coolant additive concentration must be at least 40%.
- ◆ If a stronger anti-freeze mixture is necessary due to harsher weather conditions, the coolant additive content can be increased, but only to 60 %, or the antifreeze protection will be reduced again and the cooling effect will be impaired.
- ◆ ONLY refractometer - T10007 A- may be used for determining current anti-freeze density.
- ◆ Read anti-freeze figures from respective scale for type of anti-freeze added.
- ◆ Do not reuse old coolant.

Recommended mixture ratios:

Frost protection to	Coolant additive portion	Coolant additive ²⁾	Distilled water ²⁾
-25 °C	40 %	2.9 l	4.2 l
-36 °C	50 %	3.55 l	3.55 l

2) The quantity of coolant can vary depending upon vehicle equipment.

- Install coolant temperature sender at radiator outlet - G83- with a new seal.
- Connect coolant hose -arrow- to engine oil cooler.
- Install any noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Noise insulation .
- Screw adapter - V.A.G 1274/8- onto coolant expansion tank.
- Fill coolant circuit with cooling system charge unit - VAS 6096- . ⇒ Operating instructions for cooling system charge unit VAS 6096

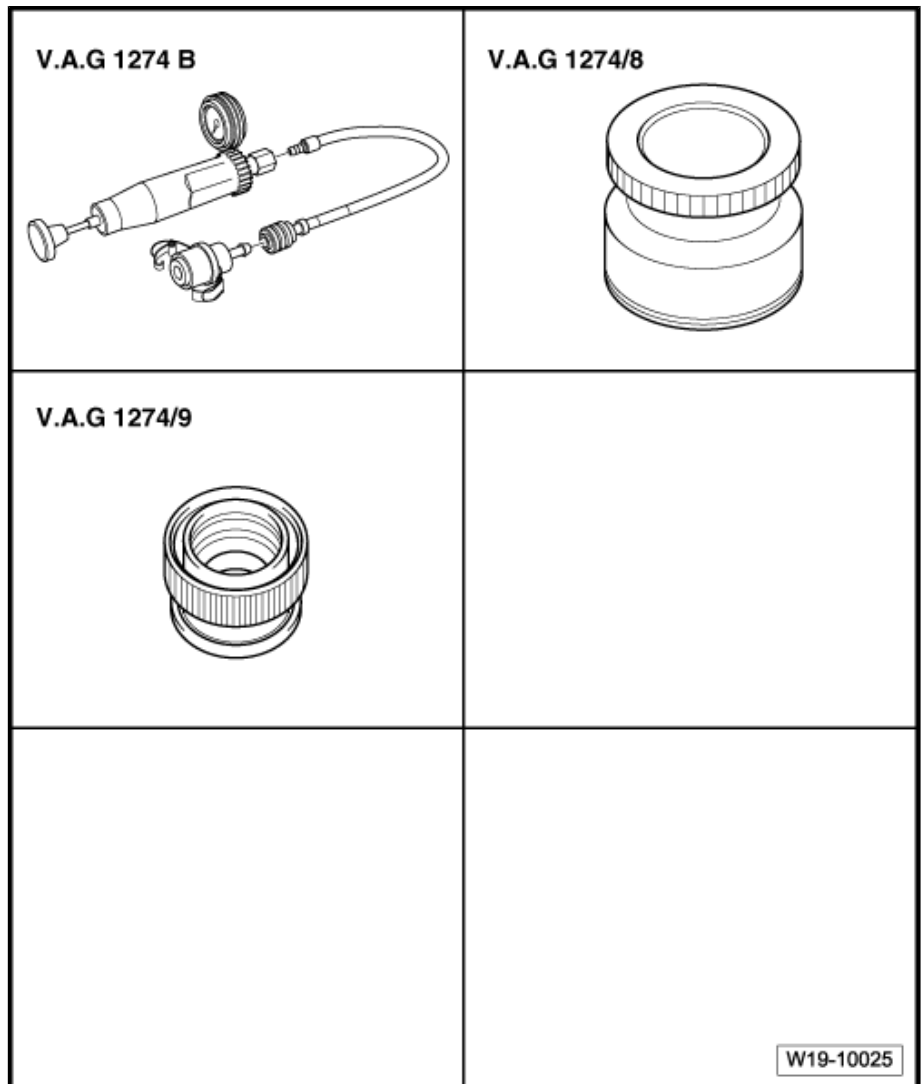




1.4 Checking cooling system for leaks

Special tools and workshop equipment required

- ◆ Cooling system tester - V.A.G 1274 B-
- ◆ Adapter for cooling system tester - V.A.G 1274/8-
- ◆ Adapter for cooling system tester - V.A.G 1274/9-



Test prerequisite

- Engine at operating temperature.
- Perform cooling system leakage test using cooling system tester - V.A.G 1274 B- and adapter for cooling system tester - V.A.G 1274/8- and adapter for cooling system tester - V.A.G 1274/9- .

Test procedure



WARNING

Steam may escape when expansion tank is opened. Wear eye protection and protective clothing to avoid eye injuries and scalding. Cover cap with cloth and open carefully.

- Open filler cap on coolant expansion tank.
- Screw adapter for cooling system tester - V.A.G 1274/8- into coolant expansion tank.



- Clamp connector - V.A.G 1274 B/1- into adapter for cooling system tester - V.A.G 1274/8- .
- Join connection piece - V.A.G 1274 B/1- to cooling system tester - V.A.G 1274 B- using connecting hose supplied.
- Using hand pump on tester, build up a pressure of approx. 1.0 bar.



DANGER!

Risk of scalding! Before the cooling system tester - V.A.G 1274 B- is disconnected from the connecting hose or the connector - V.A.G 1274 B/1- , reduction of the pressure is essential. To do this, press pressure relief valve on cooling system tester - V.A.G 1274 B- until pressure gauge displays value of »0«.

If pressure drops:

- Find leaks and rectify.

Checking pressure relief valve in filler cap

- Screw cap into adapter for cooling system tester - V.A.G 1274/9- .
- Screw connector - V.A.G 1274 B/1- into adapter for cooling system tester - V.A.G 1274/9- .
- Join connection piece - V.A.G 1274 B/1- to cooling system tester - V.A.G 1274 B- using connecting hose supplied.
- Using hand pump on cooling system tester, build up a pressure of approx. 1.6 bar.

The pressure relief valve must not open.

If the pressure relief valve opens prematurely:

- Renew cap.
- Increase pressure to over 1.6 bar.

The pressure relief valve must open.

If the pressure relief valve does not open:

- Renew cap.



2 Coolant pump, regulation of cooling system

⇒ ["2.1 Assembly overview - coolant pump, thermostat", page 113](#)

⇒ ["2.2 Removing and installing coolant pump", page 114](#)

⇒ ["2.3 Removing and installing thermostat", page 116](#)

2.1 Assembly overview - coolant pump, thermostat

1 - To coolant expansion tank

- ☐ Coolant hose schematic diagram ⇒ [page 106](#) .

2 - O-ring

- ☐ Renew after removing.

3 - Retaining clip

- ☐ Check for secure seating.

4 - Coolant temperature sender - G62-

- ☐ With coolant temperature display sender - G2- .

5 - Supply

- ☐ To auxiliary water heater, for engine codes AXB and AXC .
- ☐ To exhaust gas cooler for engine codes BRR and BRS
- ☐ Coolant hose schematic diagram ⇒ [page 106](#) .

6 - Union

7 - Bolt

- ☐ 10 Nm

8 - Return from heat exchanger

- ☐ Coolant hose schematic diagram ⇒ [page 106](#) .

9 - Bolt

- ☐ 40 Nm

10 - Coolant pipe

11 - Bolt

- ☐ 15 Nm

12 - To top of radiator

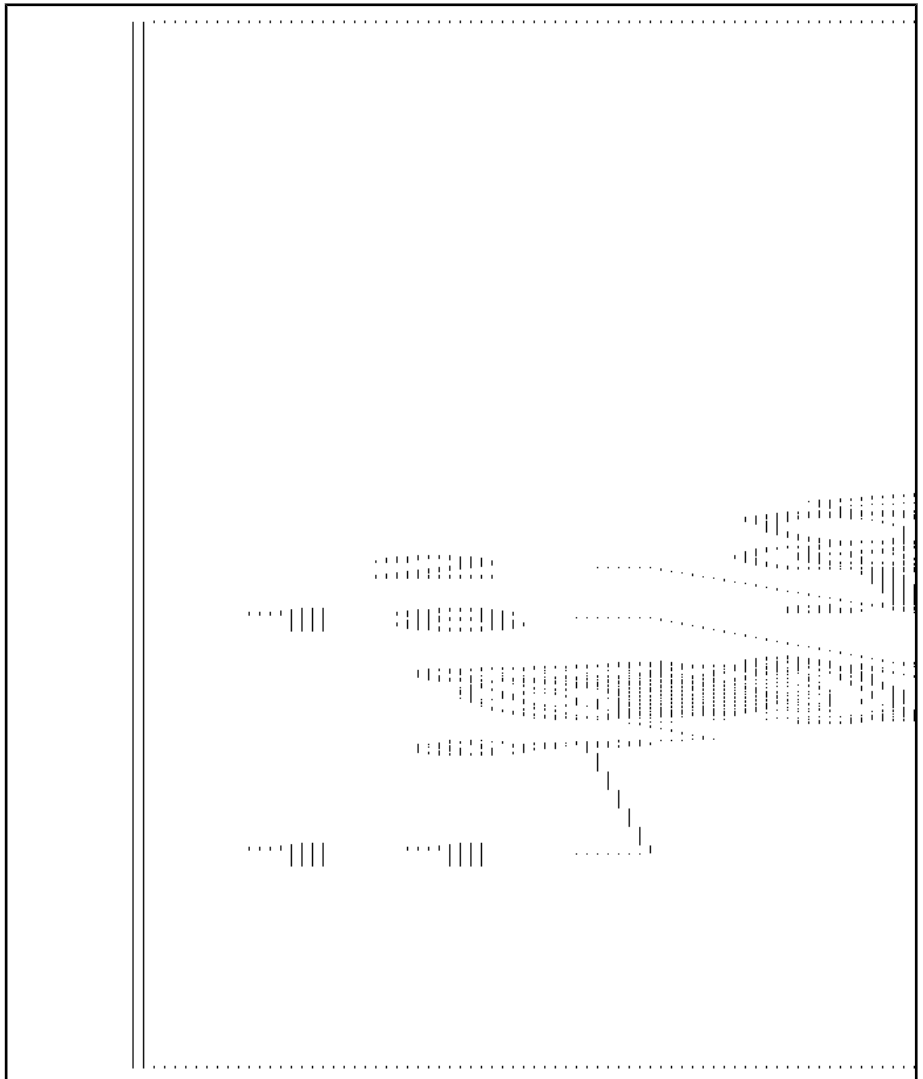
- ☐ Coolant hose schematic diagram ⇒ [page 106](#) .

13 - To lower coolant expansion tank

- ☐ Coolant hose schematic diagram ⇒ [page 106](#) .

14 - To bottom of radiator

- ☐ Coolant hose schematic diagram ⇒ [page 106](#) .





15 - Union

- ☐ For thermostat.

16 - Thermostat

- ☐ Checking: heat thermostat in water.
- ☐ Opening begins at approx. 87 °C.
- ☐ Ends at approx. 105 °C.
- ☐ Opening lift at least 7 mm.
- ☐ Note installation position ⇒ [page 116](#) .
- ☐ Removing and installing ⇒ [page 116](#) .

17 - Engine oil cooler

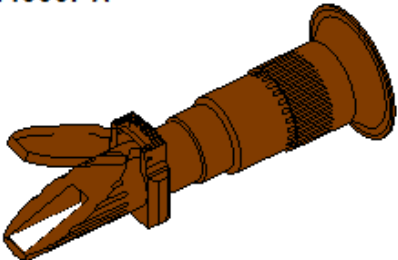
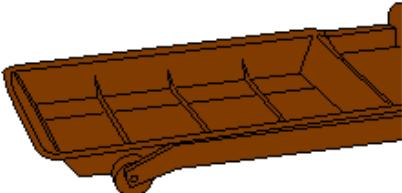

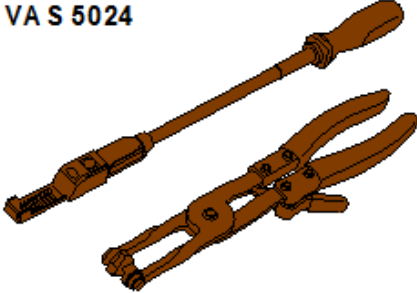
18 - Coolant pump

- ☐ Check for ease of movement.
- ☐ Note installation position.
- ☐ Removing and installing ⇒ [page 114](#) .

2.2 Removing and installing coolant pump

Special tools and workshop equipment required

- ◆ Refractometer - T10007 A-
- ◆ Drip tray - V.A.G 1306- or drip tray for workshop hoist - VAS 6208-
- ◆ Torque wrench - V.A.G 1331-
- ◆ Spring-type clip pliers - VAS 5024A-

T10007 A 	V.A.G 1306 
V.A.G 1331 	VA S 5024 

W19-10056



Removing



Note

Always renew gaskets and seals.

- Drain coolant ⇒ [page 108](#) .
- Remove poly V-belt ⇒ [page 17](#) .
- Removing, tensioning toothed belt (for vehicles ► 12.05)
⇒ [page 65](#) .
- Removing, tensioning toothed belt, (for vehicles 01.06 ►)
⇒ [page 73](#) .
- Remove coolant pump securing bolts -1- and carefully remove coolant pump -2-.

Installing

Installation is carried out in the reverse order; note the following:

- Moisten new O-ring with coolant.



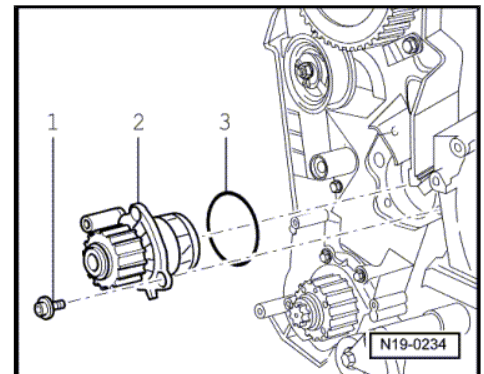
Note

The coolant pump plug faces downwards.

- Installing, tensioning toothed belt (for vehicles ► 12.05)
⇒ [page 65](#) .
- Installing, tensioning toothed belt (for vehicles 01.06 ►)
⇒ [page 73](#) .
- Install poly V-belt ⇒ [page 17](#) .
- Replenish coolant ⇒ [page 108](#) .

Specified torques

- ◆ ⇒ [“2.1 Assembly overview - coolant pump, thermostat”, page 113](#)
- ◆ ⇒ [“2.1 Assembly overview - assembly mountings”, page 14](#)
- ◆ ⇒ [“2.1 Assembly overview - toothed belt drive”, page 64](#)

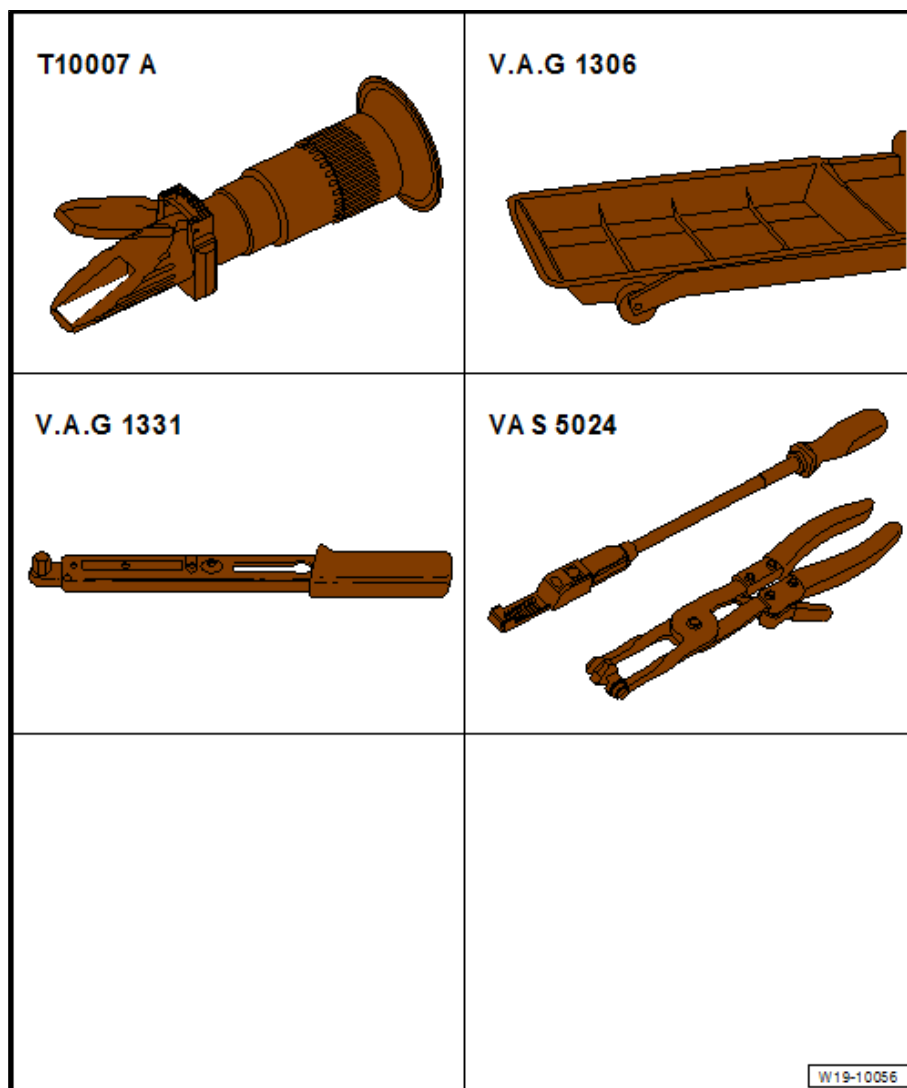




2.3 Removing and installing thermostat

Special tools and workshop equipment required

- ◆ Refractometer - T10007 A-
- ◆ Drip tray - V.A.G 1306- or drip tray for workshop hoist - VAS 6208-
- ◆ Torque wrench - V.A.G 1331-
- ◆ Spring-type clip pliers - VAS 5024A-



Removing

- Drain coolant ⇒ [page 108](#) .

Vehicles with air conditioner

- Remove alternator ⇒ Rep. gr. 27



Continuation for all vehicles

- Pull coolant hose off connection -2-.
- Remove connecting flange -2- securing bolts -1- and remove connecting flange -2- with thermostat -4-.
- Turn thermostat -4- $\frac{1}{4}$ turn (90°) to left and remove from connecting flange -2-.

Installing

Installation is carried out in the reverse order; note the following:

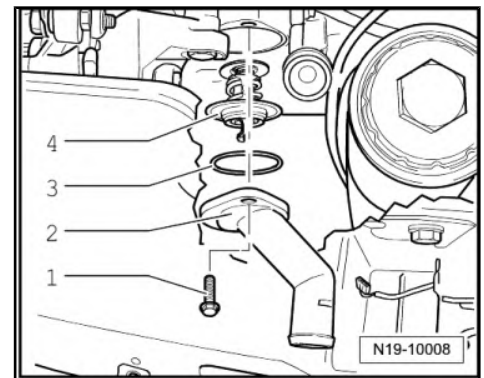
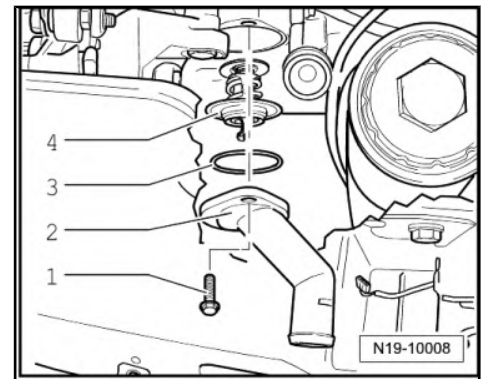


Note

- ◆ *Always renew gaskets and seals.*
- ◆ *The brace on the thermostat must be almost vertical.*
- Moisten new O-ring -3- with coolant.
- Insert thermostat -4- in union -2- and turn $\frac{1}{4}$ turn (90°) to right.
- Fit connection -2- with thermostat -4- into cylinder block.
- Tighten securing bolts -1-.
- Replenish coolant ⇒ [page 108](#) .

Specified torques

- ◆ ⇒ [“2.1 Assembly overview - coolant pump, thermostat”, page 113](#)
- ◆ Alternator; Assembly overview - alternator ⇒ Alternator; Rep. gr. 27 ; Assembly overview - alternator





3 Radiator, radiator fan

⇒ "3.1 Assembly overview - radiator, radiator fan", page 118

⇒ "3.2 Removing and installing radiator", page 119

3.1 Assembly overview - radiator, radiator fan

1 - Radiator/cooler

- ☐ After renewing, renew entire coolant.
- ☐ Removing and installing ⇒ page 119 .

2 - Rubber bush

- ☐ For top of radiator.

3 - Bolt

- ☐ 10 Nm

4 - Upper coolant hose

- ☐ Coolant hose schematic diagram ⇒ page 106 .

5 - Fan support

6 - Bolt

- ☐ 5 Nm

7 - Additional fan

- ☐ Vehicles with optional equipment only.

8 - Connector

9 - Radiator fan

10 - Coolant expansion tank

- ☐ Check using cooling system tester - V.A.G 1274- and adapter - V.A.G 1274/8- .

11 - Bolt

- ☐ 5 Nm

12 - Cap

- ☐ Check using cooling system tester - V.A.G 1274- and adapter - V.A.G 1274/9- .

13 - Retaining clip

14 - Radiator outlet coolant temperature sender - G83-

15 - O-ring

- ☐ Renew if damaged.

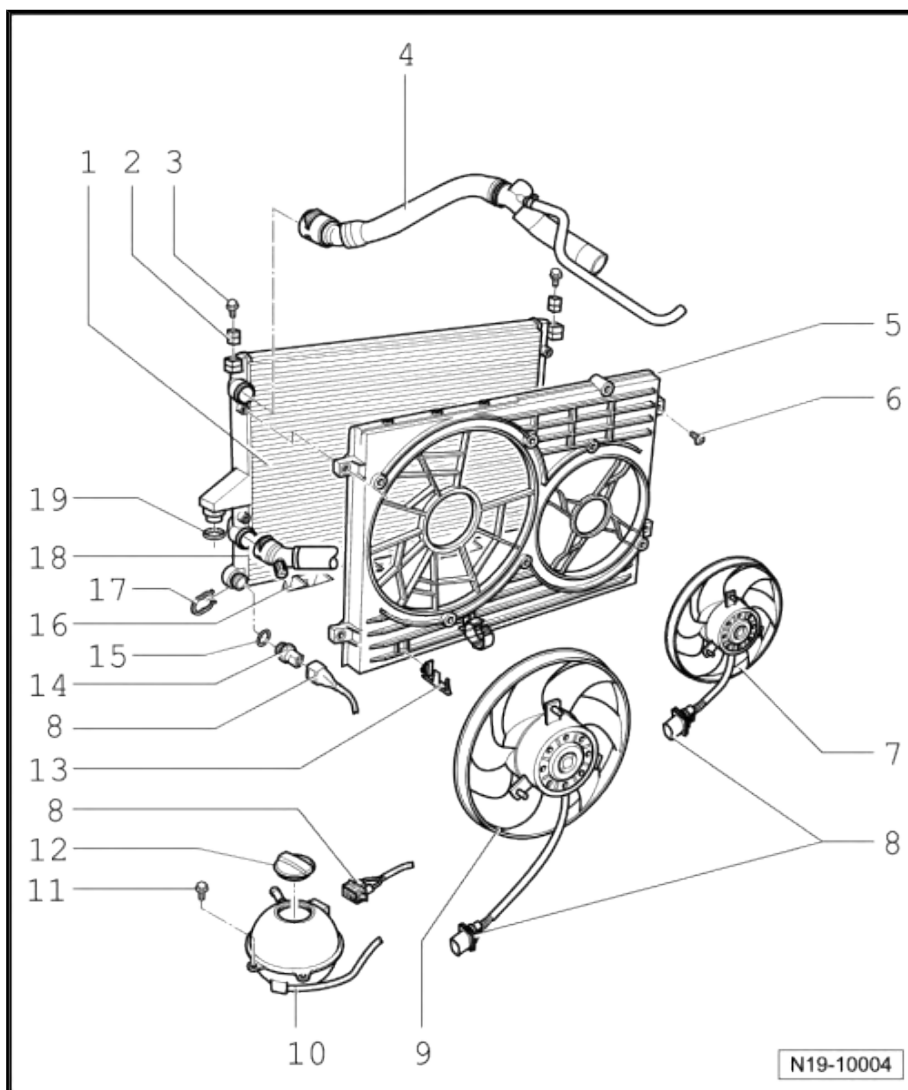
16 - Bracket

17 - Retaining clip

- ☐ Check for secure seating.

18 - Lower coolant hose

- ☐ Coolant hose schematic diagram ⇒ page 106 .





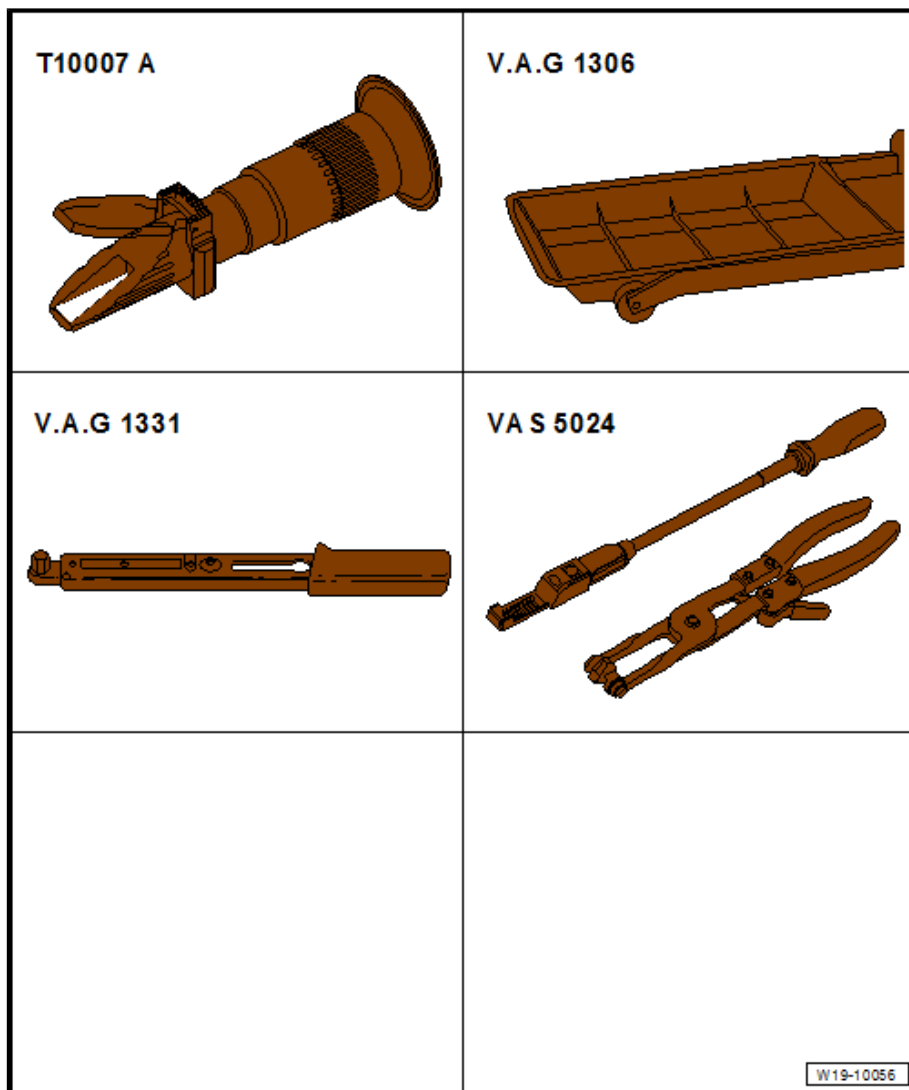
19 - Rubber bush

- ☐ For bottom of radiator

3.2 Removing and installing radiator

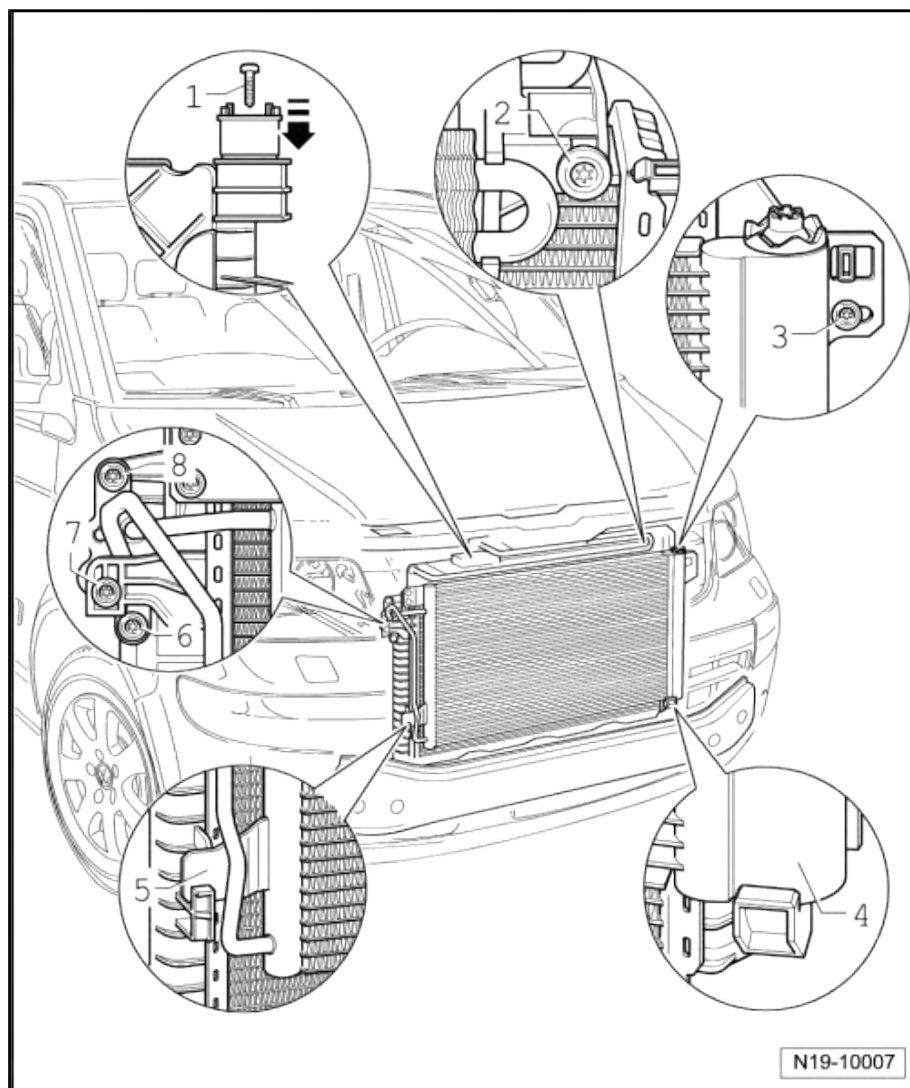
Special tools and workshop equipment required

- ◆ Refractometer - T10007 A-
- ◆ Drip tray - V.A.G 1306- or drip tray for workshop hoist - VAS 6208-
- ◆ Torque wrench - V.A.G 1331-
- ◆ Spring-type clip pliers - VAS 5024A-



Removing

- Bring lock carrier into service position ⇒ General body repairs, exterior; Rep. gr. 50 ; Body - front; Lock carrier - service position .
- Remove charge air cooler ⇒ [page 139](#) .



- Unscrew securing bolts -2- for engine oil cooler »servo oil«.
- Unclip engine oil cooler and lay to one side.
- Remove condenser securing bolts -3-, -6- and -8-.
- Lift condenser out of retainers -4- and -5- and place to side.



Note

The refrigerant lines remain connected to condenser.

- Drain coolant ⇒ [page 108](#) .
- Remove radiator securing bolt -1- and push rubber mounting in direction of arrow.
- Pull coolant hoses off radiator.



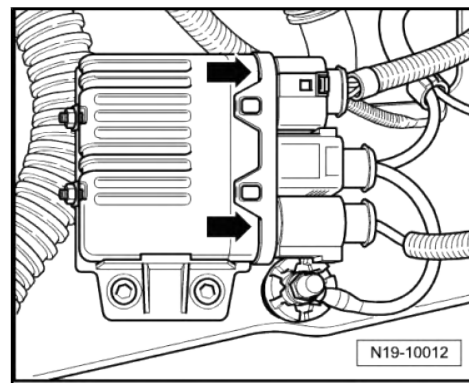
- Separate connectors -arrows- for fan on radiator fan control unit - J293- .
- Carefully remove radiator to side.

Installing

Installation is carried out in the reverse order; note the following:

Specified torques

- ◆ ⇒ [“3.1 Assembly overview - radiator, radiator fan”, page 118](#)
- ◆ ⇒ [“2.1 Assembly overview - charge air system”, page 139](#)
- ◆ Lock carrier; Assembly overview - lock carrier ⇒ Lock carrier;
Rep. gr. 50 ; Assembly overview - lock carrier





20 – Fuel supply system

1 Fuel tank

⇒ “1.1 Assembly overview - fuel tank”, page 122

⇒ “1.2 Removing and installing fuel tank”, page 124

1.1 Assembly overview - fuel tank



Caution

The fuel pump must not be allowed to run when the fuel tank is empty, as this may cause deflagrations.

The fuel tank must contain at least 5 litres of fuel.

1 - Fuel tank

- ☐ Drain fuel tank using fuel extractor - VAS 5190-
- ☐ Removing and installing ⇒ page 124 .

2 - Bush

3 - Earth connection

- ☐ Check for secure seating.

4 - Seal

- ☐ Renew if damaged.
- ☐ Moisten with fuel when installing

5 - Fuel system pressurisation pump - G6- and fuel gauge sender - G- .

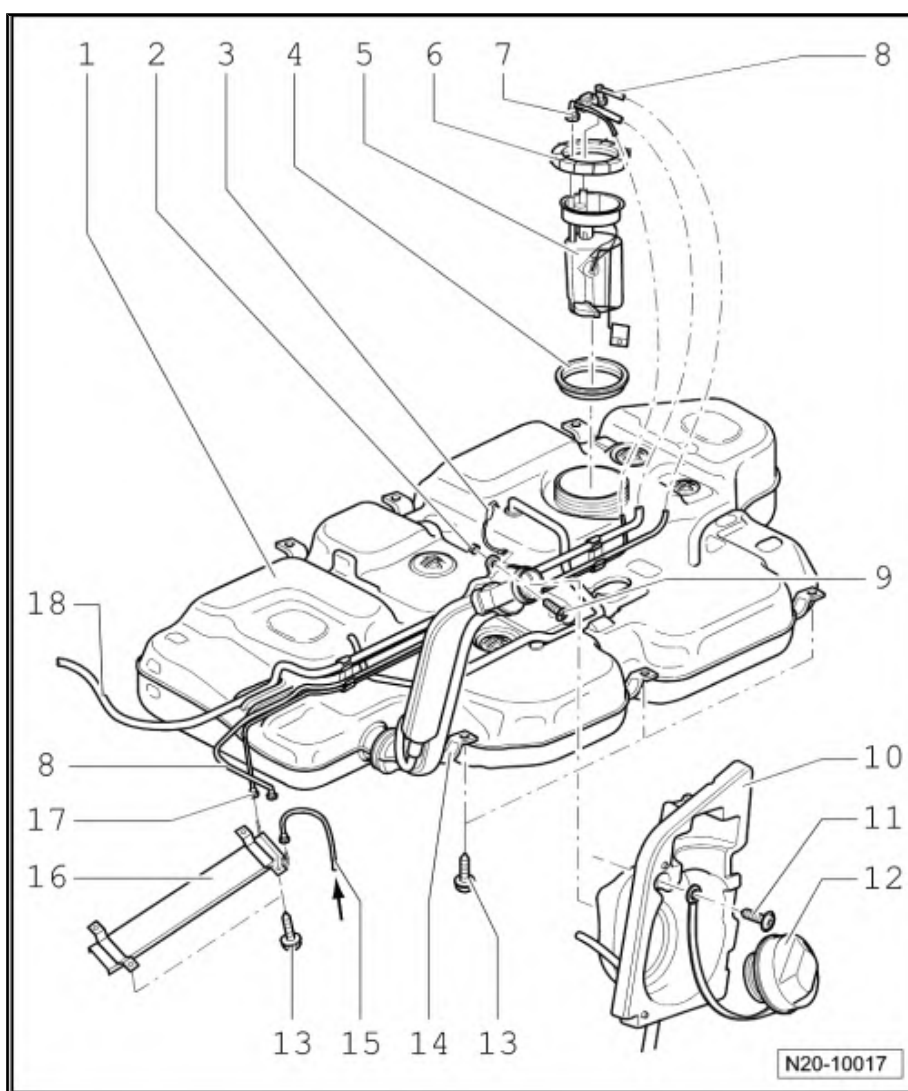
- ☐ Note installation position on fuel tank ⇒ page 123 .
- ☐ To remove, first remove fuel tank ⇒ page 124 .
- ☐ Removing and installing fuel gauge sender ⇒ page 127 .

6 - Union nut

- ☐ Remove and install using union nut tool - 3217- .
- ☐ 80 Nm

7 - Supply line

- ☐ To fuel filter ⇒ page 129 or ⇒ page 130
- ☐ Clipped onto fuel tank.
- ☐ Check for secure seating.
- ☐ Black



Volkswagen Technical Site: <http://vwts.ru> <http://vwts.info>



- ☐ To pull off flange, press release button on connecting piece.

8 - Return line

- ☐ From fuel cooler.
- ☐ Blue or with blue marking.
- ☐ Clipped onto fuel tank.
- ☐ Check for secure seating.
- ☐ To pull off flange, press release button on connecting piece.

9 - Bolt

- ☐ 12 Nm

10 - Rubber cup

11 - Securing bolt

12 - Cap

- ☐ Renew seal if damaged.

13 - Bolt

- ☐ 20 Nm

14 - Securing strap

- ☐ Note installation position.
- ☐ Check for secure seating.

15 - Return line

- ☐ From fuel filter ⇒ [page 129](#) or vacuum pump
- ☐ Blue or brown
- ☐ Check for secure seating.
- ☐ To pull off flange, press release button on connecting piece.

16 - Fuel cooler

- ☐ Not in case of vehicles without fuel preheating
- ☐ Removing and installing ⇒ [page 128](#) .

17 - Return line

- ☐ Blue or brown
- ☐ Check for secure seating.
- ☐ To pull off flange, press release button on connecting piece.

18 - Wiring harness

Installation position of fuel gauge sender

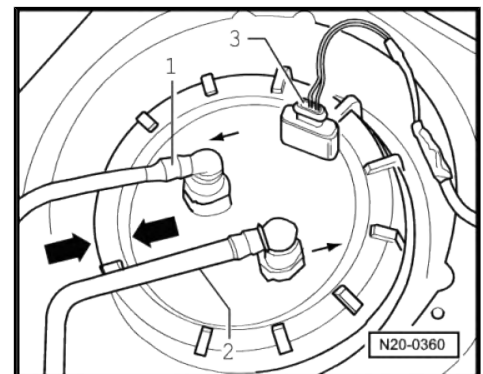
Marking on sender flange must align with the marking on fuel tank -arrows-.

Connections for blue or blue-marked return line -1- and black supply line -2- are marked with an arrow on fuel gauge sender flange.



Note

After installing fuel gauge sender, check whether fuel supply and return lines are still clipped onto fuel tank.





1.2 Removing and installing fuel tank



Caution

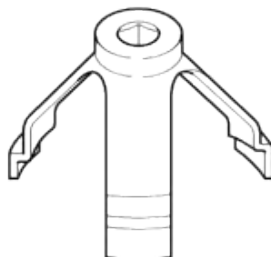
The fuel pump must not be allowed to run when the fuel tank is empty, as this may cause deflagrations.

The fuel tank must contain at least 5 litres of fuel.

Special tools and workshop equipment required

- ◆ Union nut tool - 3217-
- ◆ Torque wrench - V.A.G 1331-
- ◆ Torque wrench - V.A.G 1332-
- ◆ Engine and gearbox jack - V.A.G 1383 A-
- ◆ Fuel extractor - VAS 5190-

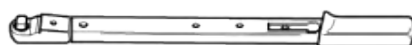
3217



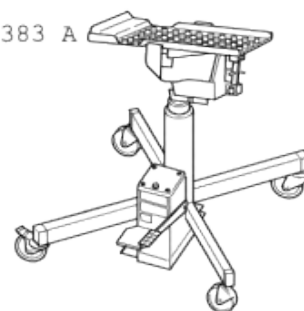
V.A.G 1331



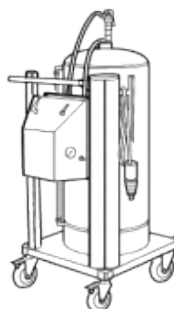
V.A.G 1332



V.A.G 1383 A



VAS 5190



W20-10000

Removing

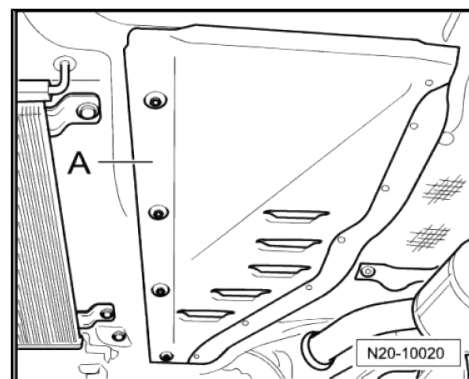


Note

- ◆ *Fuel tank must be drained. Use the fuel extractor - VAS 5190- to do this.*
- ◆ *Before carrying out further work, disconnect battery earth strap. For this reason, check whether a coded radio is fitted. Obtain anti-theft coding first if necessary.*
- Note safety precautions before starting installation work
⇒ [page 3](#) .



- Observe rules for cleanliness ⇒ [page 5](#) .
- Open fuel tank flap and remove fuel tank cap.
- Drain fuel tank and clean fuel filler neck and surrounding area.
- Remove securing bolt, then pull rubber cup off filler neck and remove.
- Unscrew securing bolt of filler neck.
- Remove lower cover with heat shield -A-.



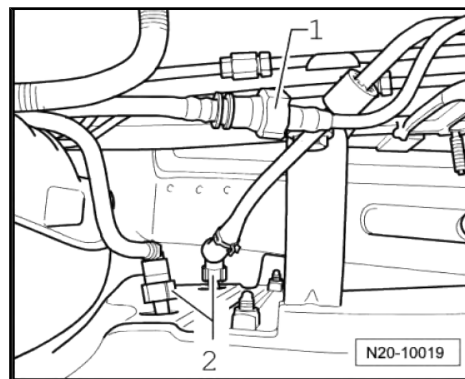


- Disconnect supply line -1- and return line -2-.



Note

- ◆ *Press in buttons on hose couplings to do this.*
- ◆ *On vehicles with auxiliary heater disconnect additional fuel line.*
- Remove fuel cooler if there is one.
- Remove securing straps. When doing this, support fuel tank with engine and gearbox jack - V.A.G 1383 A- .
- Lower engine and gearbox jack - V.A.G 1383 A- just enough to allow connector to be pulled off fuel pump flange.
- Pull connector off fuel pump flange and unclip wire from fuel tank.
- Lower fuel tank.



Installing

Installation is carried out in the reverse order; note the following:



Caution

The fuel pump must not be allowed to run when the fuel tank is empty, as this may cause deflagrations.

The fuel tank must contain at least 5 litres of fuel.

- ◆ Connections for breather and fuel lines must engage audibly when joined.
- ◆ Clip fuel lines onto fuel tank.
- ◆ Push connector onto fuel pump flange and clip wire onto fuel tank.
- ◆ Ensure that fuel hose connections are tight.

Specified torques

- ◆ ⇒ ["1.1 Assembly overview - fuel tank", page 122](#)



2 Fuel delivery unit, fuel gauge sender

⇒ [“2.1 Removing and installing fuel gauge sender G”, page 127](#)

2.1 Removing and installing fuel gauge sender - G-

Removing

- Remove fuel tank ⇒ [page 124](#) .
- Remove fuel system pressurisation pump - G6- .
- Release connector lugs on lines -3- and -4- and pull off.
- Lift retaining tabs -1- and -2- using a screwdriver and pull fuel gauge sender off downwards -arrows-.

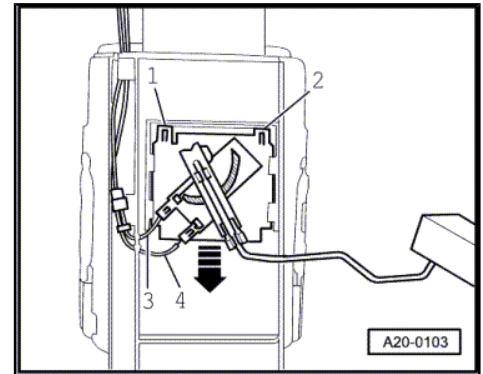
Installing

Installation is carried out in the reverse order; note the following:

- Insert fuel gauge sender - G- into guides on fuel pump and press upwards until it engages.

Specified torques

- ◆ ⇒ [“1.1 Assembly overview - fuel tank”, page 122](#)





3 Fuel cooler

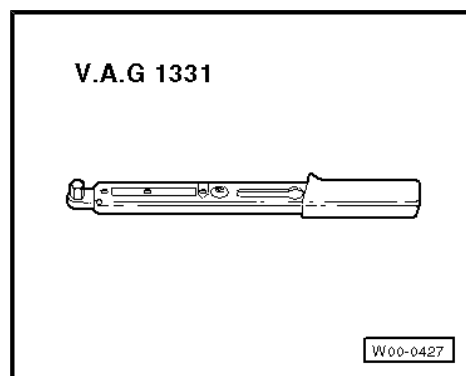
⇒ **“3.1 Removing and installing fuel cooler”, page 128**

3.1 Removing and installing fuel cooler

On vehicles without fuel preheating a fuel cooler is not installed.

Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1331-



Removing

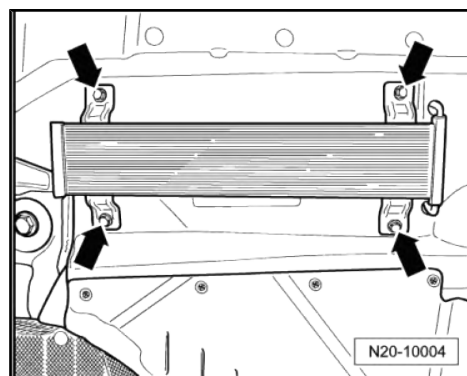
Observe rules for cleanliness ⇒ [page 5](#) .



Note

The fuel cooler is located in the return line to fuel tank. It is installed on underbody of vehicle.

- Remove underbody trim.
- Unscrew securing bolts -arrows-.



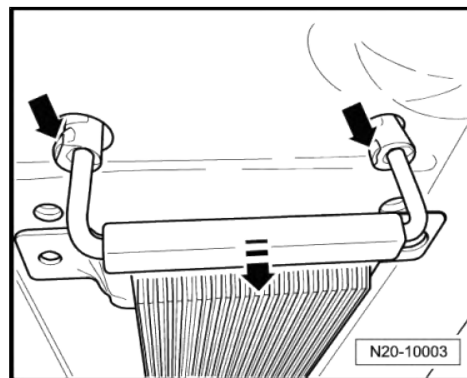
- Pull fuel cooler downwards and detach fuel lines -arrows- at fuel cooler.

Installing

Installation is carried out in the reverse order; note the following:

Specified torque

Component	Specified torque
Securing bolts for fuel cooler	20 Nm





4 Fuel filter

⇒ ["4.1 Assembly overview - fuel filter with fuel preheating", page 129](#)

⇒ ["4.2 Assembly overview - fuel filter", page 130](#)

4.1 Assembly overview - fuel filter with fuel preheating



Note

To guarantee immediate engine starting after renewing fuel filter, the fuel system must be bled ⇒ Maintenance ; Booklet 19.1

1 - Securing clip

2 - Return line

- ☐ To fuel cooler
⇒ [page 128](#)
- ☐ Clipped on fuel filter, identification -RT-
- ☐ To pull off, press release button on connection.
- ☐ Check for secure seating.
- ☐ Blue or with blue marking.

3 - Supply line

- ☐ From fuel tank.
- ☐ Clipped on fuel filter, identification -VF-
- ☐ To pull off, press release button on connection.
- ☐ Check for secure seating.
- ☐ Black

4 - Bolt

- ☐ 18 Nm

5 - Bracket

6 - Nut

- ☐ 18 Nm

7 - Fuel filter

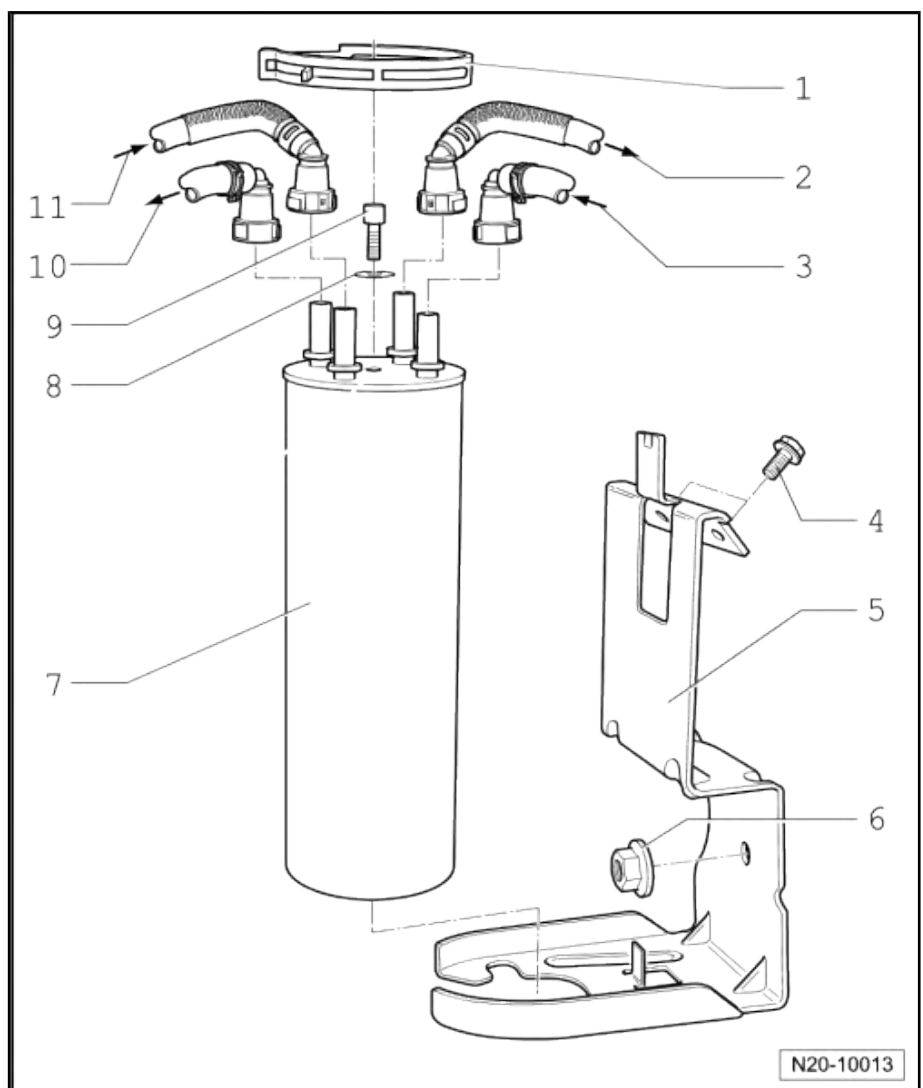
- ☐ Note installation position on bracket
⇒ [Item 5 \(page 129\)](#) .

8 - Seal

- ☐ Renew after removing.

9 - Water drain screw

- ☐ To drain water, connect hand vacuum pump and attachments - V.A.G 1390- and drainage container - V.A.G 1390/1- and extract approx. 100 cm³ of fluid.
- ☐ 4 Nm





10 - Supply line

- ☐ To vacuum pump
- ☐ Clipped on fuel filter, identification -VM-
- ☐ To pull off, press release button on connection.
- ☐ Check for secure seating.
- ☐ Black

11 - Return line

- ☐ From vacuum pump
- ☐ Clipped on fuel filter, identification -RF-
- ☐ To pull off, press release button on connection.
- ☐ Check for secure seating.
- ☐ Blue or with blue marking.

4.2 Assembly overview - fuel filter



Note

To guarantee immediate engine starting after renewing fuel filter, the fuel system must be bled ⇒ Maintenance ; Booklet 19.1



1 - Supply hose

- ☐ To vacuum pump
- ☐ Union with marking - VM-.
- ☐ Check for secure seating.
- ☐ To pull off, press release button on connection.

2 - Supply line

- ☐ From fuel tank.
- ☐ Black
- ☐ Union with marking - VF-.
- ☐ Check for secure seating.
- ☐ To pull off, press release button on connection.

3 - Fuel filter

- ☐ Observe change intervals.
- ☐ Note installation position.

4 - Bracket

- ☐ For fuel filter.

5 - Bolt

- ☐ 9 Nm

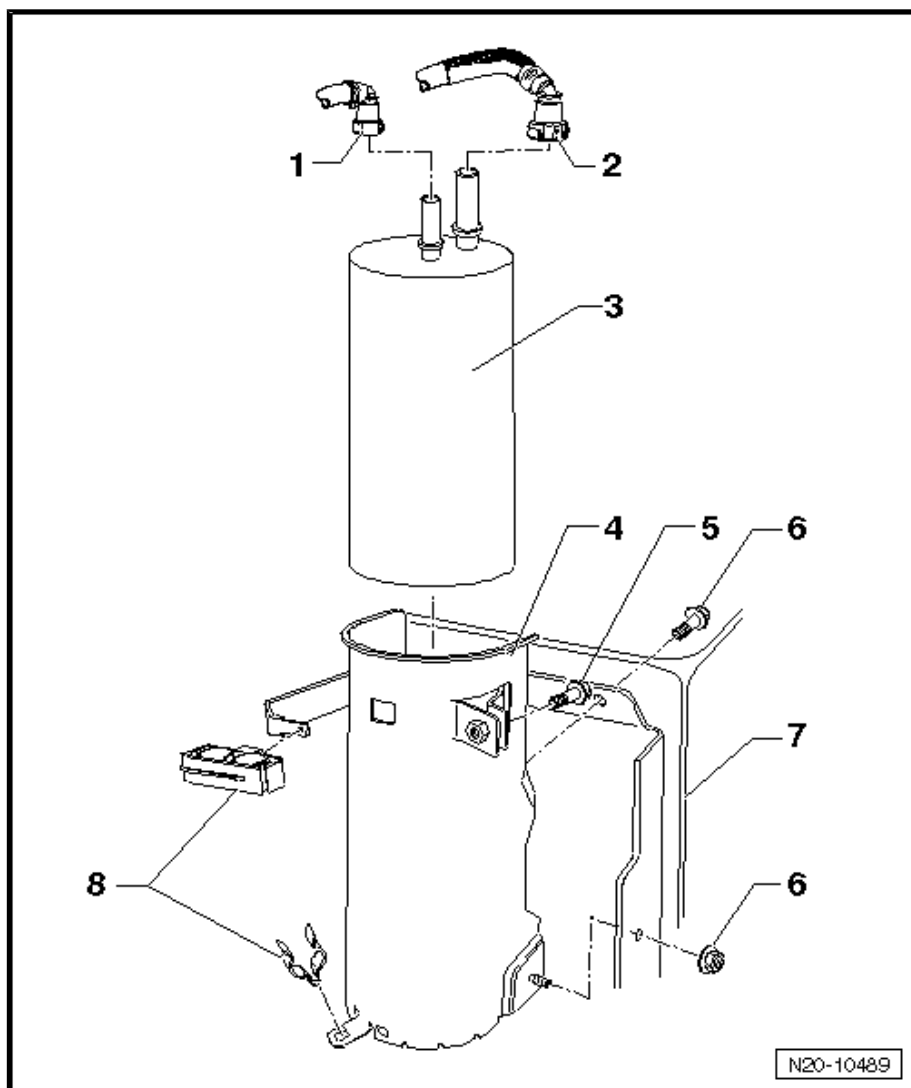
6 - Bolt/nut

- ☐ 18 Nm

7 - Bracket

8 - Bracket

- ☐ For fuel hoses





5 Accelerator mechanism

⇒ ["5.1 Assembly overview - accelerator mechanism", page 132](#)

5.1 Assembly overview - accelerator mechanism

1 - Bearing bracket

- ❑ Removing and installing
⇒ Brake system; Rep.
gr. 46 ; Brake pedal;
Removing and installing
- brake pedal

2 - Connector

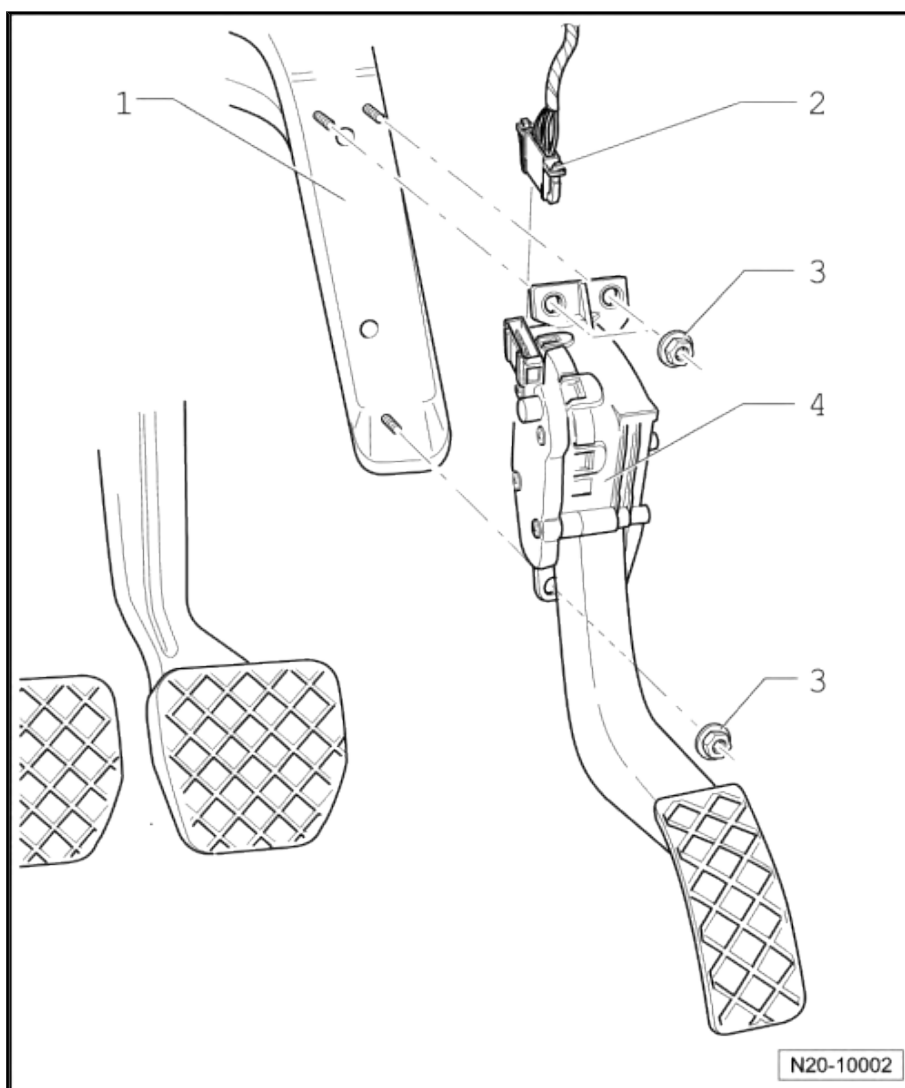
- ❑ Black, 6-pin.

3 - Nut

- ❑ 10 Nm

4 - Accelerator position sender - G79-

- ❑ Not adjustable.
- ❑ The accelerator position sender - G79- transmits the driver's input to the engine control unit





21 – Turbocharging/supercharging

1 Turbocharger

⇒ [“1.1 Assembly overview - turbocharger, engine codes AXB and AXC”, page 133](#)

⇒ [“1.2 Assembly overview - turbocharger, engine codes BRR and BRS”, page 135](#)

⇒ [“1.3 Removing and installing turbocharger”, page 137](#)

1.1 Assembly overview - turbocharger, engine codes AXB and AXC

1 - Exhaust manifold

- ☐ With exhaust turbo-charger
- ☐ Only renew complete

2 - From charge air cooler

3 - Intake manifold

4 - Gasket

- ☐ Renew after removing.
- ☐ Coating (beading) to-wards intake manifold

5 - Bolt

- ☐ 25 Nm

6 - Gasket

- ☐ Renew after removing.
- ☐ Note installation posi-tion.

7 - Bolt

- ☐ 25 Nm

8 - Support

- ☐ Between turbocharger and cylinder block.

9 - Washer

10 - Nut

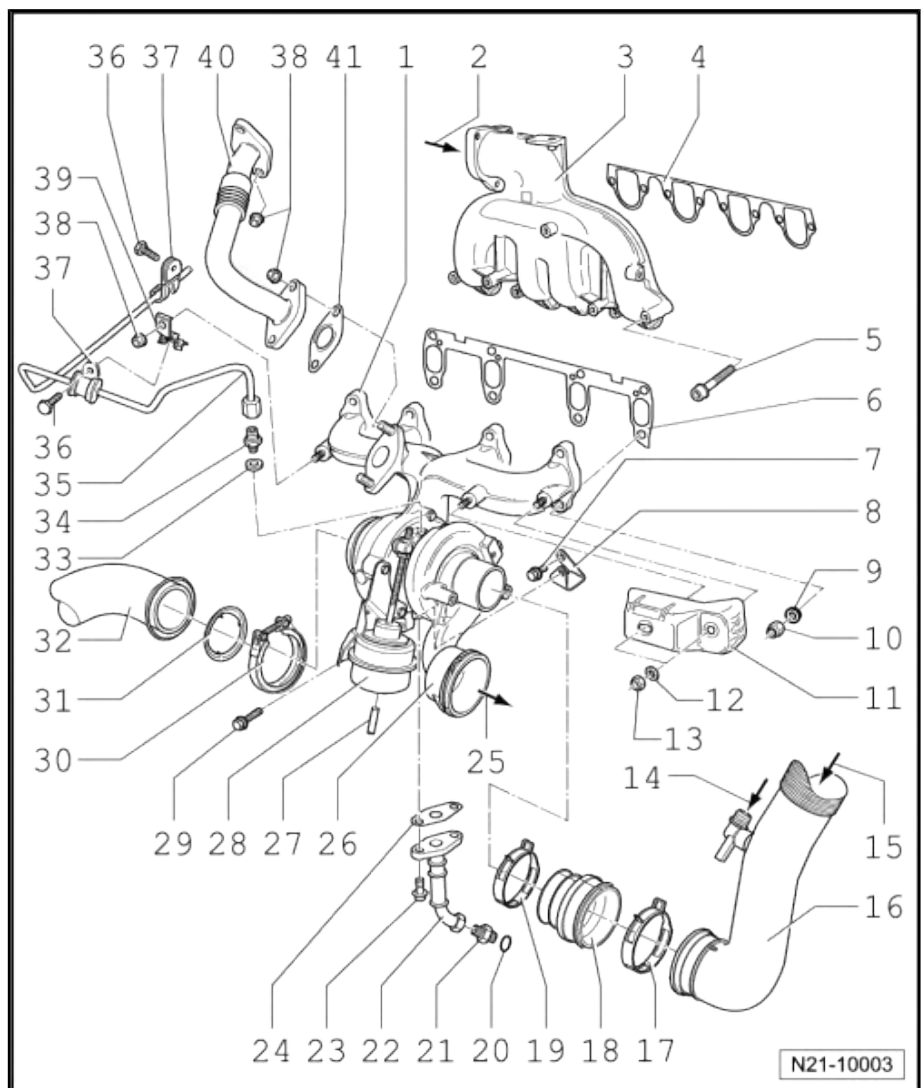
- ☐ 25 Nm

11 - Heat shield

12 - Washer

13 - Nut

- ☐ 25 Nm





14 - From pressure regulating valve

15 - From air filter.

16 - Connecting hose

17 - Spring-type clip

18 - Connecting piece

19 - Spring-type clip

20 - Seal

- ☐ Renew after removing.

21 - Union

- ☐ 40 Nm

22 - Oil return line

- ☐ To cylinder block.
- ☐ Union nut - 22 Nm

23 - Bolt

- ☐ 17 Nm

24 - Gasket

- ☐ Renew after removing.

25 - To charge air cooler

26 - Turbocharger

- ☐ Can only be renewed with exhaust manifold.
- ☐ Removing and installing ⇒ [page 137](#) .

27 - Vacuum hose

- ☐ To charge pressure control solenoid valve - N75- schematic diagram ⇒ [page 151](#) .

28 - Vacuum unit

- ☐ For charge pressure control.
- ☐ Part of turbocharger.

29 - Bolt

- ☐ First hand tighten all bolts
- ☐ 20 Nm

30 - Clip

- ☐ 7 Nm

31 - Gasket

- ☐ Renew after removing.
- ☐ Note installation position.

32 - Front exhaust pipe

33 - Seal

- ☐ Renew after removing.

34 - Union

- ☐ Renew after removing.
- ☐ Coat threads and bolt head seating surface with high-temperature paste ⇒ Electronic Parts catalogue (ETKA) .
- ☐ 30 Nm

35 - Oil supply line

- ☐ Before installing oil supply line, ensure that it is not blocked.
- ☐ Before installing, fill turbocharger with engine oil through oil supply line connection.



- ☐ Removing and installing ⇒ [page 103](#) .

36 - Bolt

- ☐ 10 Nm
- ☐ Removing and installing oil supply line ⇒ [page 103](#)

37 - Retaining clamp

- ☐ Removing and installing oil supply line ⇒ [page 103](#)

38 - Nut

- ☐ 25 Nm

39 - Bracket

- ☐ For oil supply line ⇒ [Item 35 \(page 134\)](#) .
- ☐ Secure oil supply line before fitting it.

40 - Connecting pipe

- ☐ To intake connecting pipe.

41 - Gasket

- ☐ Renew after removing.

1.2 Assembly overview - turbocharger, engine codes BRR and BRS

1 - Nut

- ☐ 20 Nm

2 - Gasket

- ☐ Renew after removing.

3 - Exhaust manifold

- ☐ With exhaust turbo-charger
- ☐ Only renew complete

4 - Exhaust gas temperature sender 1 - G235-

- ☐ For vehicles with particulate filter.
- ☐ Grease thread of sender using high-temperature paste ⇒ Electronic Parts Catalogue (ET-KA) .
- ☐ 45 Nm

5 - Gasket

- ☐ Renew after removing.
- ☐ Note installation position.

6 - Bolt

- ☐ 25 Nm

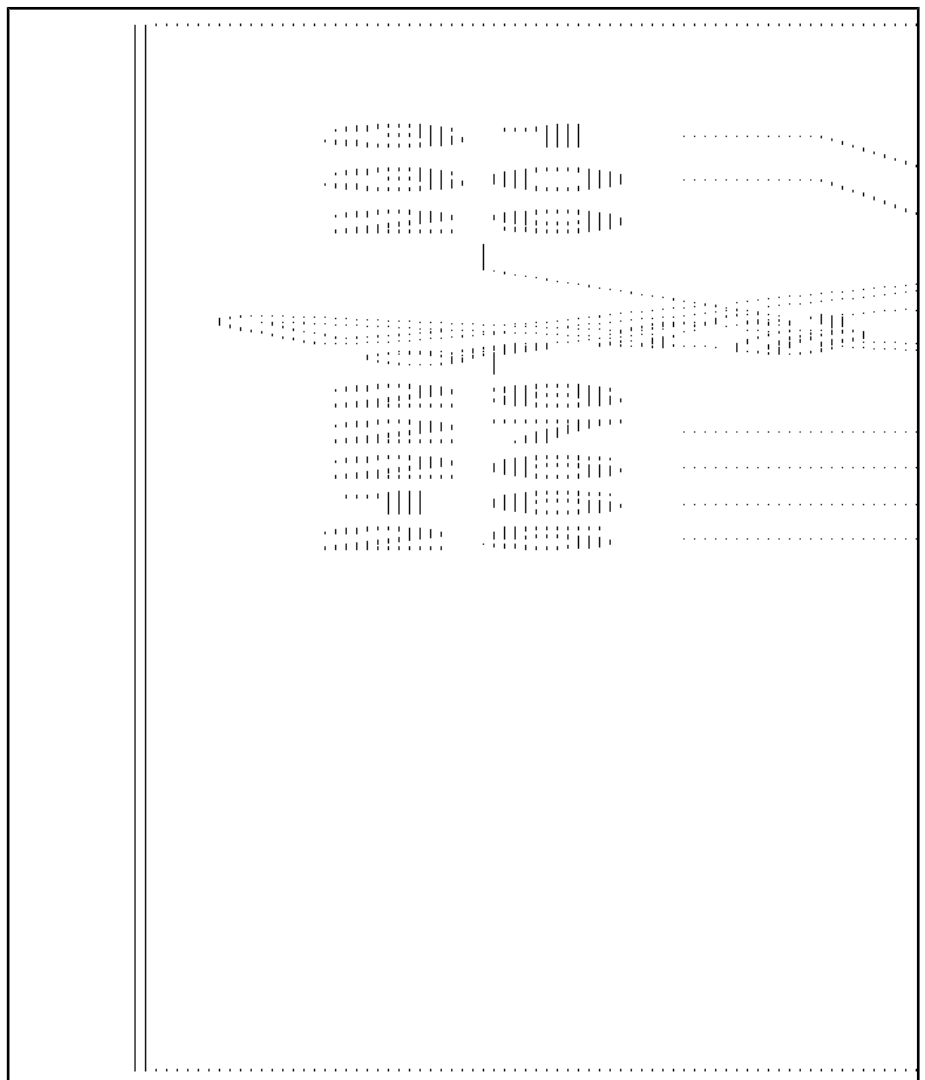
7 - Support

- ☐ Between turbocharger and cylinder block.

8 - Washer

9 - Nut

- ☐ 25 Nm





10 - Heat shield

11 - From pressure regulating valve

12 - From air filter.

13 - Connecting hose

14 - Spring-type clip

15 - Connecting piece

16 - Seal

- ☐ Renew after removing.

17 - Union

- ☐ 40 Nm

18 - Oil return line

- ☐ To cylinder block.
- ☐ Union nut - 22 Nm

19 - Bolt

- ☐ 17 Nm

20 - To charge air cooler

21 - Turbocharger

- ☐ Can only be renewed with exhaust manifold.
- ☐ Removing and installing ⇒ [page 137](#) .

22 - Vacuum hose

- ☐ To charge pressure control solenoid valve - N75- , schematic diagram ⇒ [page 152](#) or ⇒ [page 153](#) .

23 - Vacuum unit

- ☐ For charge pressure control.
- ☐ Part of turbocharger.

24 - Bolt

- ☐ First hand tighten all bolts
- ☐ 20 Nm

25 - To particulate filter

- ☐ ⇒ [Item 10 \(page 162\)](#)
- ☐ To front exhaust pipe on vehicles without particulate filter ⇒ [Item 3 \(page 158\)](#) .

26 - Union

- ☐ Renew after removing.
- ☐ Coat threads and bolt head seating surface with high-temperature paste ⇒ Electronic Parts catalogue (ETKA) .
- ☐ 30 Nm

27 - Oil supply line

- ☐ Before installing oil supply line, ensure that it is not blocked.
- ☐ Before installing, fill turbocharger with engine oil through oil supply line connection.
- ☐ Removing and installing ⇒ [page 103](#) .

28 - Bolt

- ☐ Removing and installing oil supply line ⇒ [page 103](#)
- ☐ 10 Nm

29 - Retaining clamp

- ☐ For oil supply line ⇒ [Item 27 \(page 136\)](#) .

30 - Nut

- ☐ 25 Nm



31 - Bracket

- ☐ For oil supply line ⇒ [Item 27 \(page 136\)](#) .
- ☐ Secure oil supply line before fitting it.

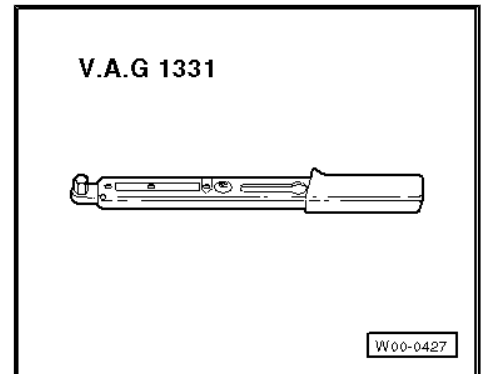
32 - Connecting pipe

- ☐ To exhaust gas recirculation cooler ⇒ [Item 5 \(page 168\)](#) .

1.3 Removing and installing turbocharger

Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1331-



Note

- ◆ *All hose connections are secured.*
- ◆ *Charge air system must be free of leaks.*
- ◆ *Renew self-locking nuts.*
- ◆ *Before screwing on oil supply line, fill turbocharger at connection with engine oil.*
- ◆ *After installing turbocharger, run engine for about 1 minute at idling speed to ensure that oil is supplied to turbocharger.*

Observe rules for cleanliness ⇒ [page 5](#) .



Caution

When a mechanical fault is found on the turbocharger, e.g. a destroyed compressor impeller, it is not only sufficient to renew the turbocharger. To prevent this from causing further damage, perform the following repairs:

- ◆ *Check air filter housing, air filter element and intake hoses for soiling.*
- ◆ *Check complete charged air routing and charge air cooler for foreign objects.*

If foreign objects are found in the charge air system, the charged air routing must be cleaned and the charge air cooler must be renewed, if necessary.

Removing

Vehicles with particulate filter

- Remove particulate filter ⇒ [page 163](#) .



- Separate connector from exhaust gas temperature sender 1 - G235- and open cable ties of wiring harness.

Vehicles without particulate filter

- Remove front exhaust pipe ⇒ [page 158](#) .

Continuation for all vehicles

- Remove connecting hoses ⇒ [Item 16 \(page 134\)](#) and ⇒ [Item 13 \(page 136\)](#) .
- Remove oil supply line ⇒ [page 103](#) .
- Pull vacuum hose off turbocharger vacuum unit.
- Remove exhaust gas recirculation connecting pipe.
- Unbolt oil return line -2- from cylinder block.
- Unscrew securing bolt of turbocharger -1-.
- Unscrew securing nuts of heat shield and exhaust manifold.
- Remove turbocharger with exhaust manifold downwards.

Installing

Installation is carried out in the reverse order; note the following:

Engine codes AXB and AXC

- Install oil supply line ⇒ [Item 3 \(page 103\)](#) .

Engine codes BRR and BRS

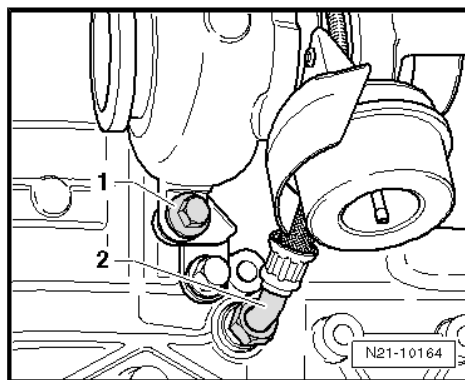
- Install oil supply line ⇒ [page 103](#) .
- Observe installation instructions for particulate filter ⇒ [page 163](#) .

Continuation for all engine codes

- Checking engine oil level.

Specified torques

- ◆ ⇒ [“1.1 Assembly overview - turbocharger, engine codes AXB and AXC”, page 133](#)
- ◆ ⇒ [“1.2 Assembly overview - turbocharger, engine codes BRR and BRS”, page 135](#)
- ◆ ⇒ [“1.1 Assembly overview - silencers/catalytic converters”, page 158](#)
- ◆ ⇒ [“1.2 Assembly overview - silencers/particulate filter”, page 159](#)





2 Charge air system

⇒ [“2.1 Assembly overview - charge air system”, page 139](#)

⇒ [“2.2 Assembly overview - charge-air hose connections”, page 140](#)

⇒ [“2.3 Checking charge air system for leaks”, page 141](#)

2.1 Assembly overview - charge air system

1 - Intake manifold flap motor - V157-

2 - Securing clip

3 - O-ring

- ☐ Renew after removing.
- ☐ Black

4 - Connecting hose

5 - Connecting pipe

6 - Connecting hose

7 - Charge air cooler

- ☐ To remove and install, remove bumper cover
⇒ General body repairs, exterior; Rep. gr. 63 ; Front bumper cover .

8 - Bolt

- ☐ 8 Nm

9 - O-ring

- ☐ Renew after removing.
- ☐ Green

10 - O-ring

- ☐ Renew after removing.

11 - Connecting hose

12 - Intake manifold pressure sender - G71- with intake manifold temperature sender - G72-

- ☐ For engine codes BRR and BRS: intake air temperature sender - G42- with charge pressure sender - G31- .

13 - Bolt

- ☐ 3 Nm

14 - From turbocharger

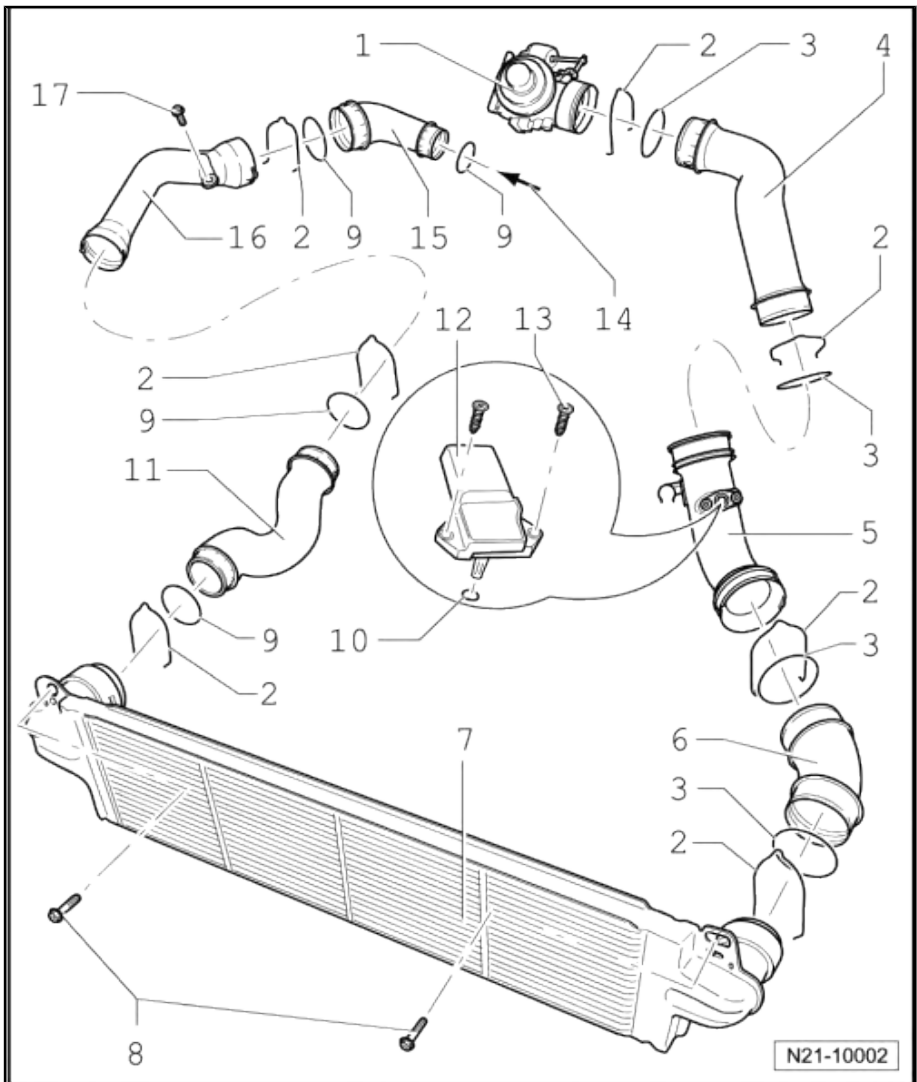
15 - Connecting hose

16 - Connecting pipe

- ☐ Secured to engine bracket.

17 - Bolt

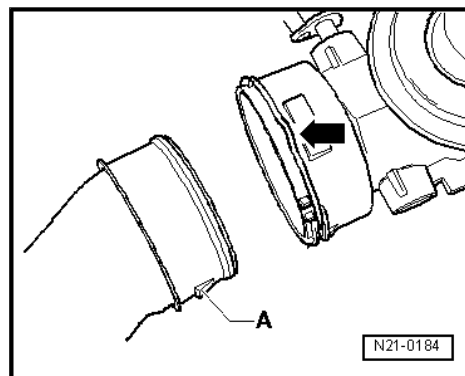
- ☐ 10 Nm





Note

- ◆ Charge air system must be free of leaks.
- ◆ For assembly use lubricant (water without additive) if necessary. Do not use lubricants containing oil.
- ◆ When making repairs, remove oil from connection and hose ends.
- ◆ All hose connections of charge air system are secured by spring-type clips or by connector couplings. Always check the following points with push-on connectors:
- ◆ Release connection by pulling the locking clip -arrow-.
- ◆ Pull hose/pipe connection off without the use of tools.
- ◆ When installing, ensure the locking lugs -A- engage correctly.



2.2 Assembly overview - charge-air hose connections



Caution

The seal in the plug-in connector can be damaged if the securing clip is in the locked position when fitting the connector.

This can cause leakage.

Observe installation instructions.

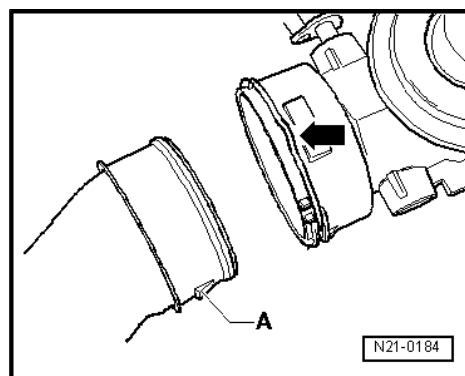
Removing

- Release plug-in connector by pulling out retaining clip -arrow-.
- Separate hose/pipe without tools.

Installing

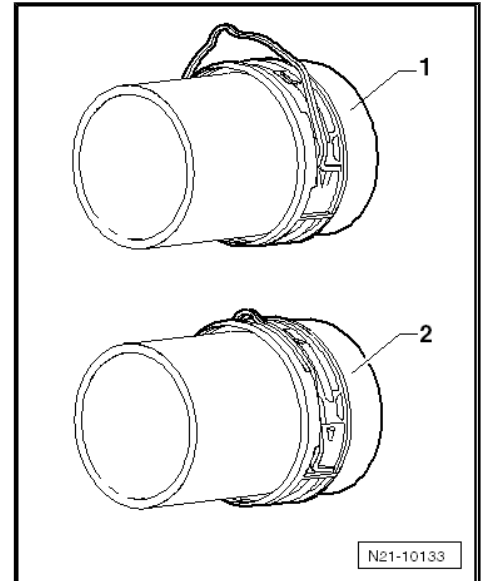
Installation is carried out in the reverse order; note the following:

- If renewed, place oil seal in groove of charge air hose.
- Make sure seal is completely slotted into the groove all round.
- Coat sealing surfaces and oil seal with oil.





- Bring retaining clip to release position -1-.
- Push charge air hose into coupling as far as stop.
- Bring retaining clip to locking position -2- and then press charge air hose again.
- By pulling on hose, check whether connector coupling seats correctly and is properly engaged.

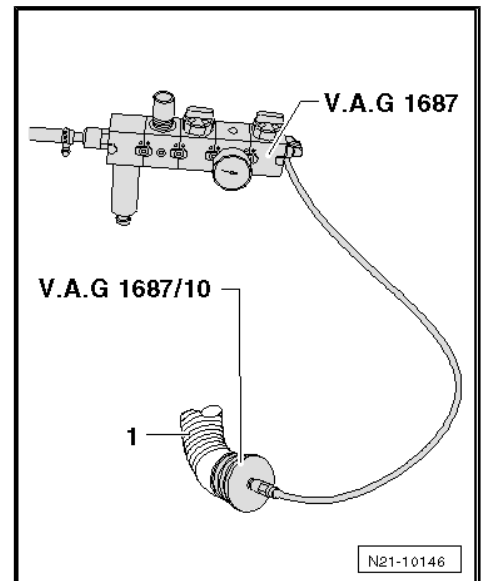


2.3 Checking charge air system for leaks

Special tools and workshop equipment required

- ◆ Charge air system tester - V.A.G 1687-
- ◆ Adapter - V.A.G 1687/10-
- ◆ Adapter - V.A.G 1687/4-
- Remove intake hose -1- from air filter.
- Insert adapter - V.A.G 1687/10- into intake hose -1- and secure with a clip.
- Detach hose from crankcase breather system valve and seal.

Prepare charge air system tester - V.A.G 1687- as follows:

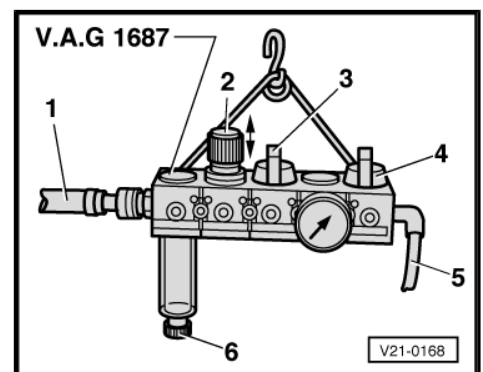


- Unscrew pressure control valve -2- completely and close valves -3- and -4-.



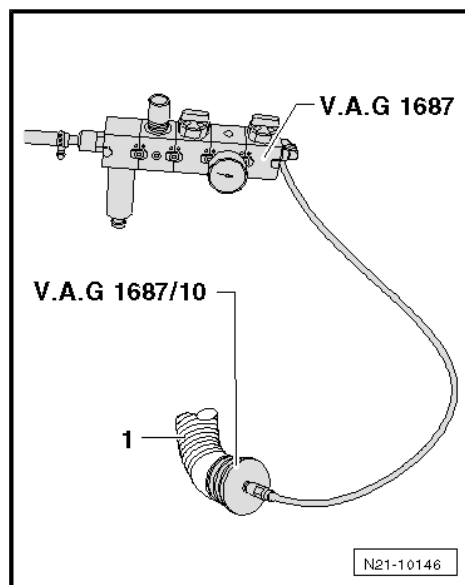
Note

To turn the pressure regulating valve -2- the knob must be pulled upwards.





- Connect charge air system tester - V.A.G 1687- to adapter - V.A.G 1687/10- as shown.



- Connect compressed air hose -1- (compressed air supply) to charge air system tester - V.A.G 1687- .



Note

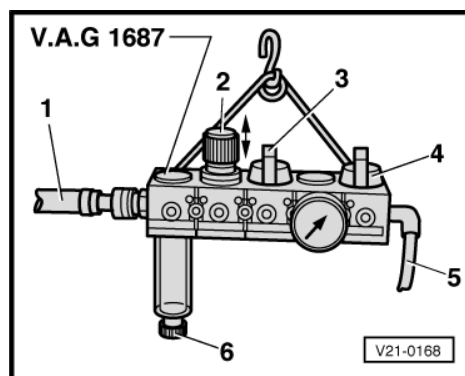
If water is in inspection glass, drain via drain screw -6-.

- Open valve -3-.
- Adjust pressure to 0.5 bar with pressure control valve -2-.



Caution

The pressure must not exceed 0.5 bar! If the pressure is too high this can cause damage to the engine.



- Open valve -4- and wait until test circuit is full. If necessary, regulate pressure to 0.5 bar.
- Check charge air system for leaks by listening, touching, with commercially available leak detector spray or using ultrasonic tester - V.A.G 1842- .



Note

- ◆ *How to use the ultrasonic tester - V.A.G 1842- ⇒ operating instructions*
- ◆ *If a leak has been located, observe notes for charge air system when carrying out any repair work ⇒ [page 139](#) ..*
- ◆ *Depressurise test circuit by detaching coupling from adapter - V.A.G 1687/10- before removing adapter.*



23 – Mixture preparation - injection

1 Injectors

⇒ [“1.1 Assembly overview - injectors”, page 143](#)

⇒ [“1.2 Removing and installing O-rings for unit injector”, page 144](#)

⇒ [“1.3 Removing and installing injectors”, page 146](#)

⇒ [“1.4 Removing and installing prewiring for unit injectors”, page 148](#)

1.1 Assembly overview - injectors

◆ Observe rules for cleanliness ⇒ [page 5](#) .

◆ Always renew seals and O-rings

1 - Bolt

- ☐ Renew after removing.
- ☐ 20 Nm + 90°

2 - Rocker arm shaft

- ☐ With rocker arms
- ☐ Removing and installing
⇒ [page 146](#) .

3 - Lock nut

- ☐ 30 Nm

4 - Adjuster screw

- ☐ Renew after removing.
- ☐ Observe notes on re-
newing ⇒ [page 146](#)

5 - Ball stud

- ☐ Renew after removing.
- ☐ Observe notes on re-
newing ⇒ [page 146](#)

6 - Unit injector

- ☐ Removing and installing
⇒ [page 146](#) .

7 - O-ring

- ☐ Renew. ⇒ [page 144](#) .

8 - O-ring

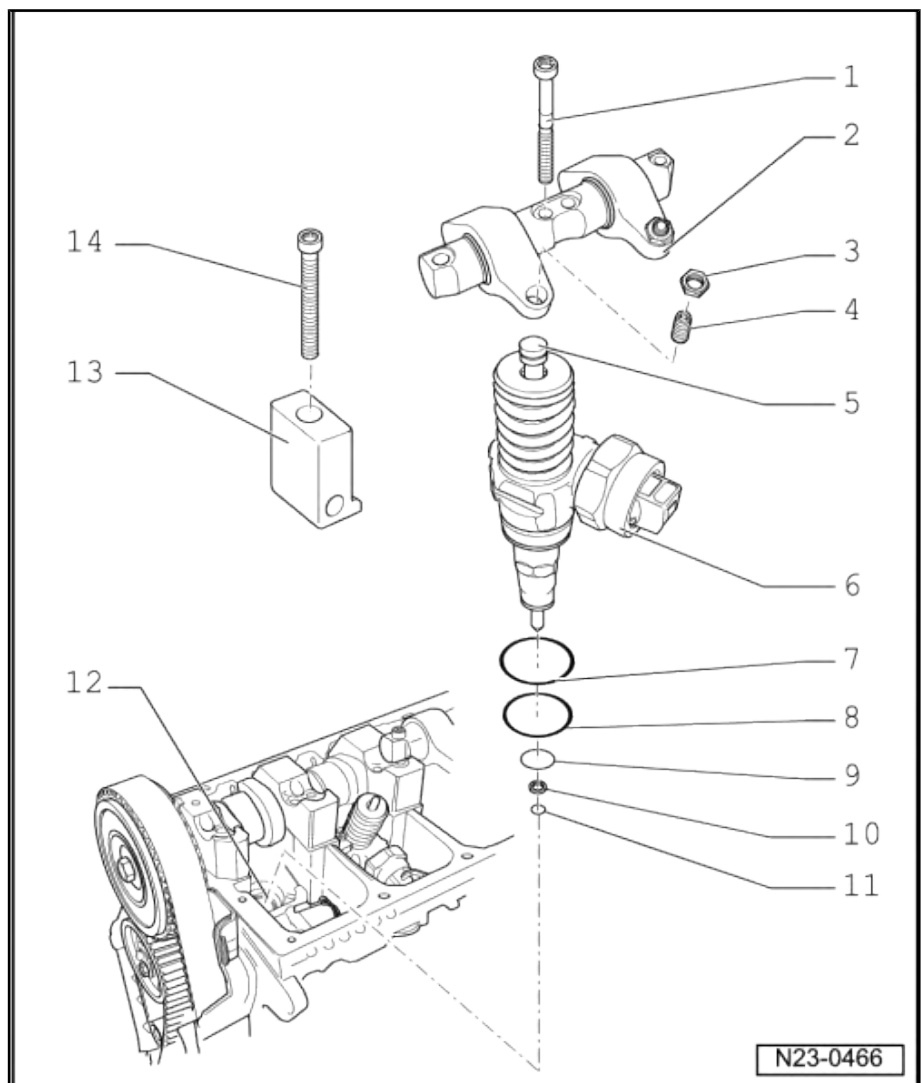
- ☐ Renew. ⇒ [page 144](#) .

9 - O-ring

- ☐ Renew. ⇒ [page 144](#) .

10 - Heat shield seal

- ☐ Renew after removing.



Volkswagen Technical Site: <http://vwts.ru> <http://vwts.info>



11 - Circlip

12 - Cylinder head

13 - Tensioning block

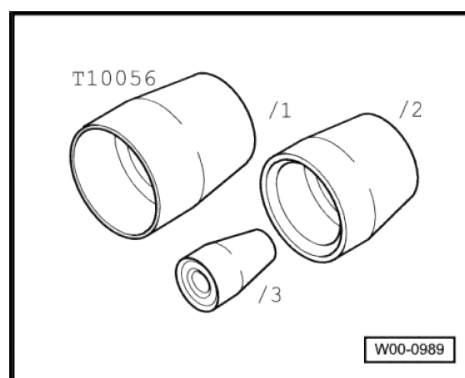
14 - Bolt

- ☐ Renew after removing.
- ☐ 12 Nm + 270° further

1.2 Removing and installing O-rings for unit injector

Special tools and workshop equipment required

- ◆ Assembly sleeves - T10056-



Removing

- Lever old O-rings very carefully out of unit injector.
- Pay particular attention to ensure that seat of O-ring is not damaged by burrs.

Installing

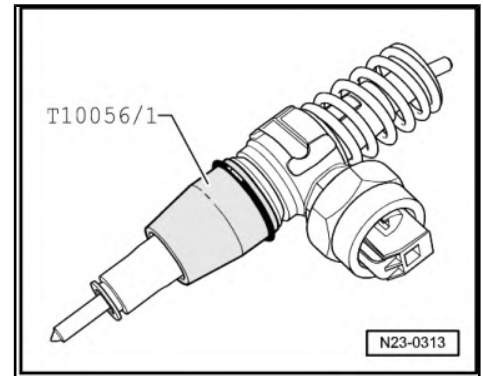


Note

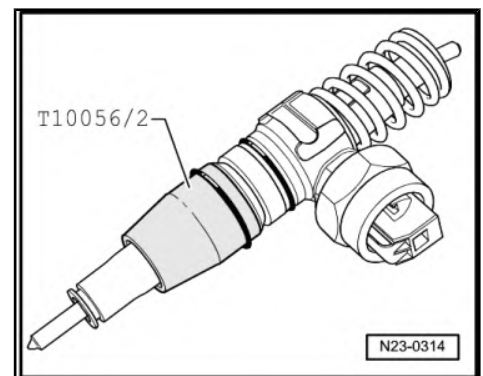
- ◆ *Always use the assembly sleeves to fit the O-rings. There is a danger of damaging the O-rings if the sleeves are not used.*
- ◆ *Gradual introduction of O-rings without different coloured markings. Note the correct allocation of O-rings to grooves: the thickness of the rings reduces towards injector nozzle.*
- ◆ *Avoid any rolling movement when pushing O-rings on. The O-rings must not be twisted in their seats in unit injector.*
- Remove heat shield seal together with circlip.
- Clean seating surfaces for O-rings on unit injector very carefully.



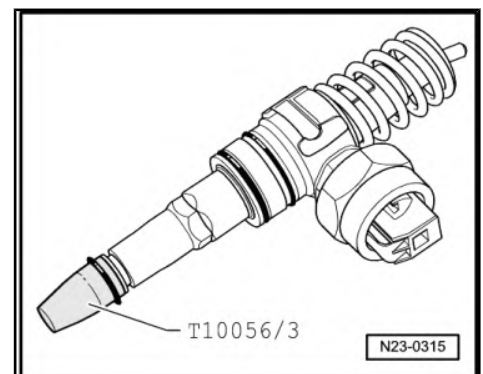
- Slide assembly sleeve - T10056/1- onto unit injector as far as stop.
- Push upper, thicker O-ring carefully onto assembly sleeve and into seat on unit injector.
- Remove assembly sleeve.



- Slide assembly sleeve - T10056/2- onto unit injector as far as stop.
- Push middle, thinner O-ring carefully onto assembly sleeve and into seat on unit injector.
- Remove assembly sleeve.



- Slide assembly sleeve - T10056/3- onto unit injector as far as stop.
- Push lower O-ring carefully onto assembly sleeve and into seat on unit injector.
- Remove assembly sleeve.
- Slide new heat shield seal together with circlip into position.

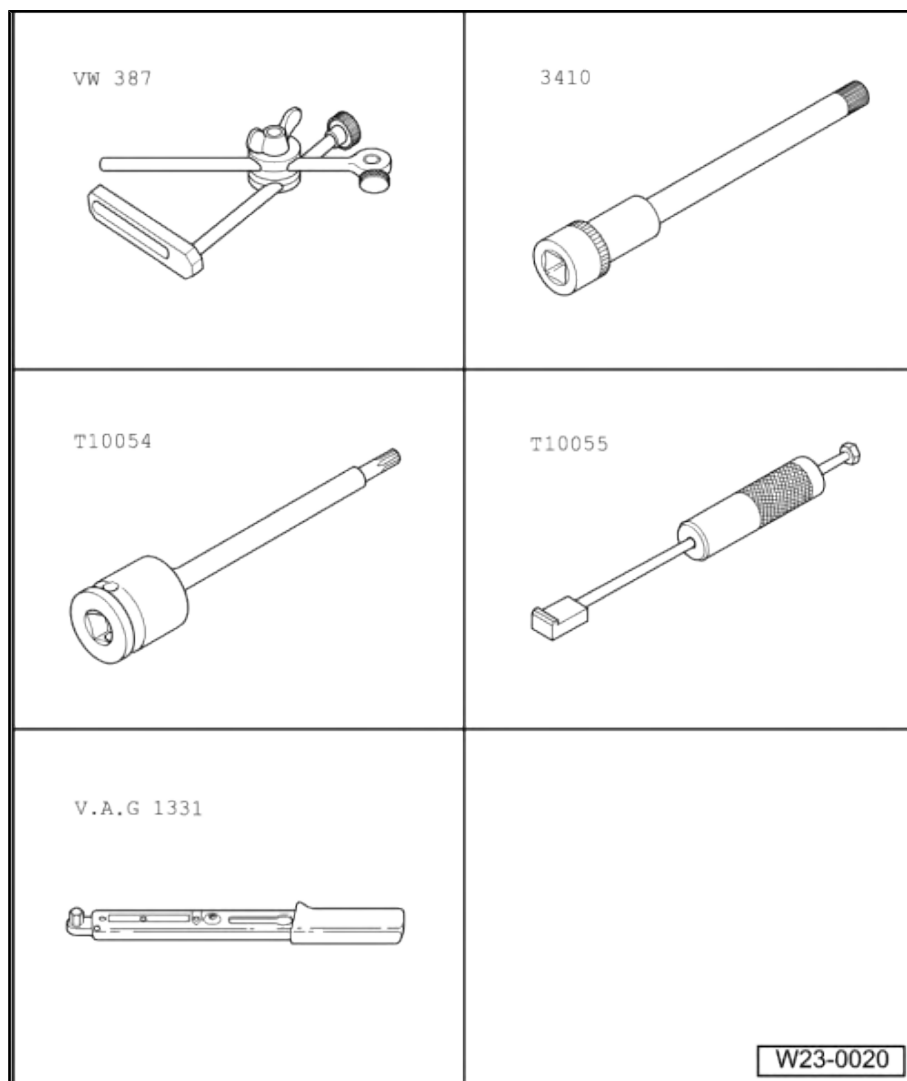




1.3 Removing and installing injectors

Special tools and workshop equipment required

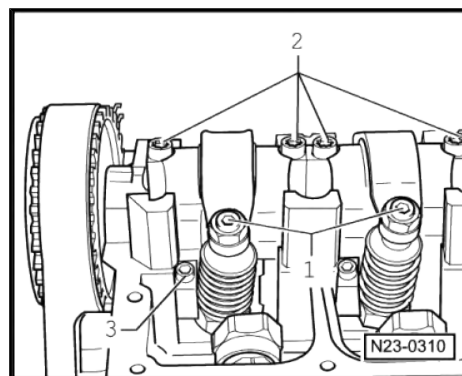
- ◆ Universal dial gauge bracket - VW 387-
- ◆ Socket XZN 10 - 3410-
- ◆ Special wrench, long reach XZN 6 - T10054-
- ◆ Puller - T10055-
- ◆ Torque wrench - V.A.G 1331-



Removing

- Remove upper part of toothed belt guard and cylinder head cover.
- Turn crankshaft until the cam pair of the respective unit injector to be removed evenly points upwards.
- Loosen lock nuts of adjustment screws -1- and remove adjustment screws.
- Loosen securing bolts -2- for rocker arm shaft working from outside to inside using Socket XZN 10 - 3410-. Remove rocker arm shaft.
- Loosen securing bolt -3- for clamping block using XZN 10 socket - T10054- and remove clamping block.
- Prise off connector from unit injector using screwdriver. To avoid canting, support opposite side of connector with light finger pressure.

Observe cylinder allocation of unit injectors.





- Insert puller - T10055- in place of clamping block into slot on side of unit injector.
- Pull unit injector upwards out of cylinder head seat by means of gentle tapping.

Installing

Installation is carried out in the reverse order; note the following:



Note

- ◆ *Each time the rocker arm shaft is removed and each time work is performed which requires adjustment of the unit injector, the adjustment screws ➔ [Item 4 \(page 143\)](#) and the ball pins ➔ [Item 5 \(page 143\)](#) of the unit injectors must be renewed.*
- ◆ *New unit injectors are supplied with O-rings and heat shield seal.*
- ◆ *The seals must not be twisted.*
- If old unit injector is reused, renew heat insulation seal and O-rings ➔ [page 144](#) .
- Check that 3 O-rings, heat shield seal and circlip are seated correctly before installing unit injector.
- Lubricate oil seals and insert unit injector into cylinder head with great care.
- Apply even pressure to push unit injector into cylinder head seat as far as stop.
- Insert clamping block in slot on side of unit injector.



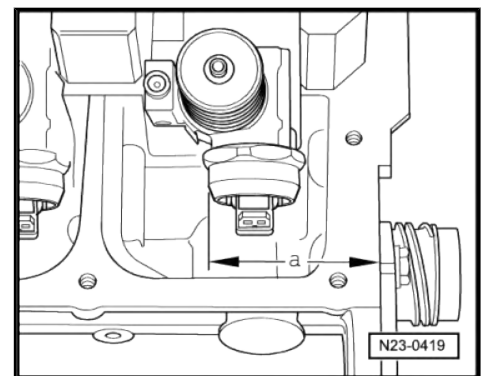
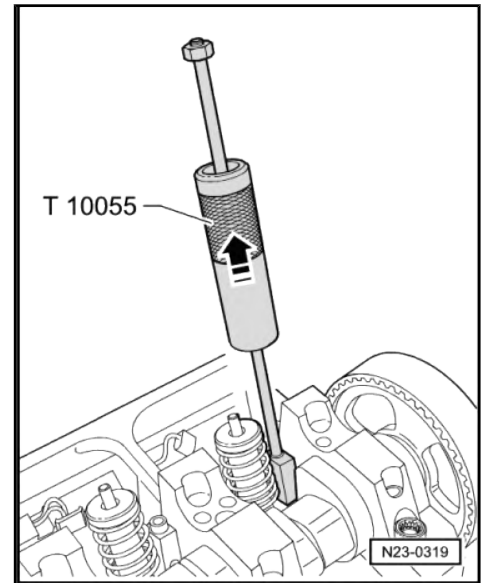
Note

If the unit injector is not at right angles to the tensioning block the securing bolt may loosen and this can damage the unit injector or the cylinder head.

- Thus, align unit injector as follows.
- Screw new securing bolt as far as possible into clamping block while still being able to turn unit injector easily).
- Align unit injector at right angles to camshaft bearing seats.
- Check dimension “a” from outer edge of cylinder head to rounded edge of unit injector with a vernier gauge (measuring range at least 400 mm).

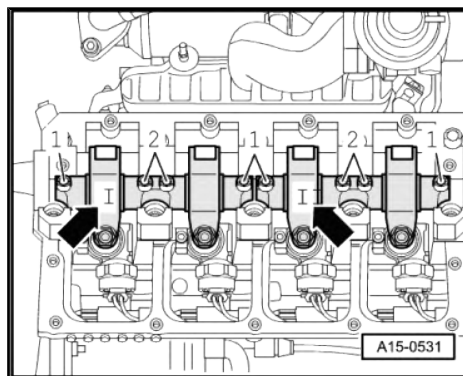
Cylinder	Dimension “a”
1	333.0 ± 0.8 mm
2	245.0 ± 0.8 mm
3	153.6 ± 0.8 mm
4	65.6 ± 0.8 mm

- Realign unit injector if necessary and tighten securing bolt.
- Renew unit injector ball studs ➔ [Item 5 \(page 143\)](#) .

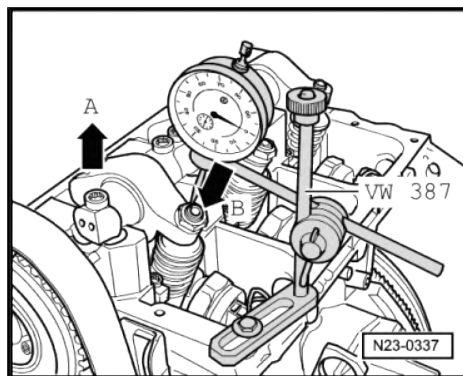




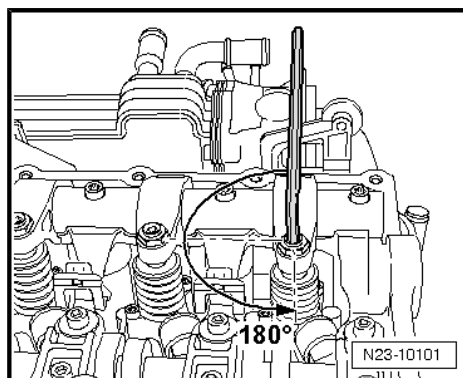
- Fit rocker arm shafts with new adjustment screws and tighten new securing bolts as follows:
- First tighten inner bolts -2- then outer bolts -1- by hand. Tighten in same sequence.



- Fit dial gauge onto adjustment screw of unit injector as shown.
- Turn crankshaft in direction of engine rotation until roller of rocker arm is located at tip of drive cam. Roller side -arrow A- positioned at highest point, dial gauge -arrow B- positioned at lowest point.
- Remove dial gauge.
- Now turn adjustment screw into rocker arm until significant resistance can be felt (unit injector is at limit stop).



- Slacken adjustment screw of stop by 180°.
- Hold adjuster bolt in this position and tighten lock nut.
- Fit unit injector connector and install cylinder head cover ⇒ [page 53](#).
- Install toothed belt guard.
- Read event memory ⇒ Vehicle diagnostic tester.



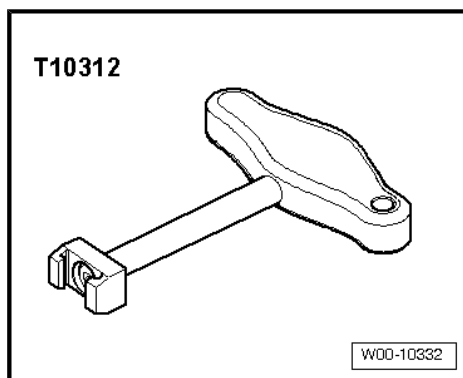
Specified torques

- ◆ ⇒ ["1.1 Assembly overview - injectors", page 143](#)
- ◆ ⇒ ["1.1 Assembly overview - cylinder head", page 44](#)

1.4 Removing and installing prewiring for unit injectors

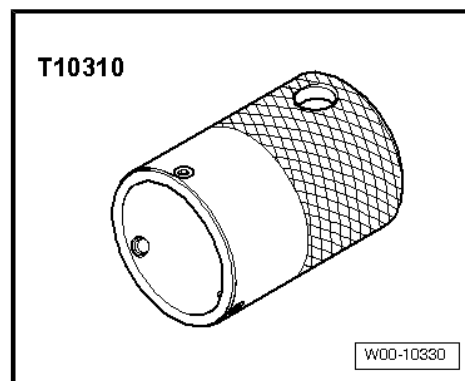
Special tools and workshop equipment required

- ◆ Puller - T10312-





◆ Wrench - T10310-



Removing



Caution

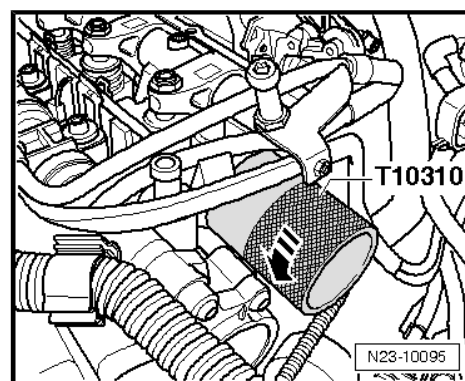
Removal and installation of the pre-wired wiring harness may only be undertaken by unscrewing the clips. Releasing the cable guide from the clips bends the clips which may break the cables due the excessive play. This also applies when changing the unit injectors and all work which does not require the central connector to be completely removed.



Note

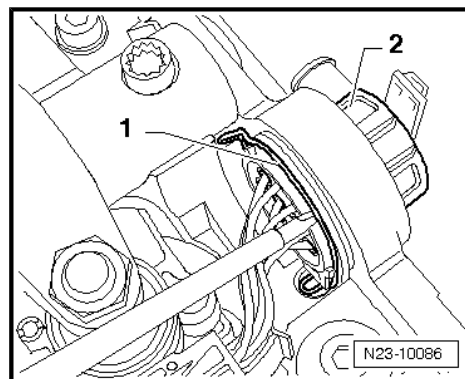
Connectors on piezo unit injectors may only be disconnected using special tool puller - T10312- .

- Remove cylinder head cover ⇒ [page 53](#) .
- Disconnect central connector on cylinder head.
- Remove both bolts of central connector on cylinder head.
- Fit special wrench - T10310- on adapter ring and release it by turning key through 90° (1/4 turn) in -direction of arrow-.





- If fitted, pull securing clip -1- upwards slightly with a screwdriver and press central connector -2- through inwards.

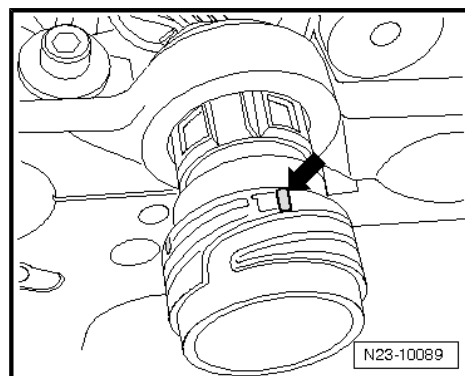
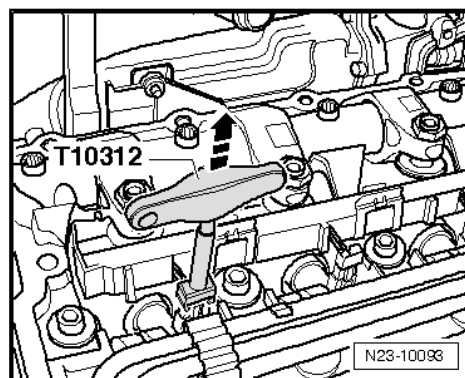


- Slide the puller - T10312- onto the unit injector connector from the side and pull it off in -direction of arrow-. Use long-nosed pliers for the older connector version.
- Pull pre-wiring harness out of cylinder head.

Installing

Installation is carried out in the reverse order; note the following:

- Guide pre-wiring harness into cylinder head, ensure clips seat securely in cylinder head.
- Fit adapter ring (colour marked "longer" stud -arrow- faces 12 o'clock)

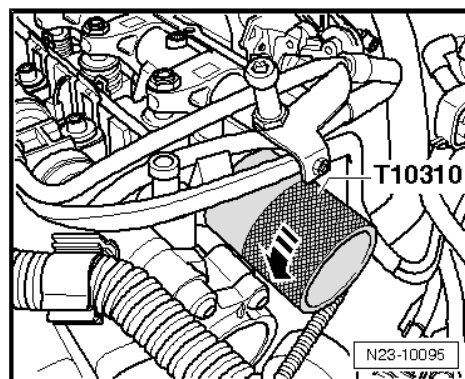


- Fit special wrench - T10310- on adapter ring and lock it by turning key through 90° (1/4 turn) in opposite -direction of arrow-.
- Secure central connector bolts to cylinder head.

Note

When adapter ring is installed correctly the colour marked "shorter" stud faces 12 o'clock.

- Fit central connector to cylinder head and lock in position.
- Install cylinder head cover ➔ [page 53](#) .



Specified torques

- ♦ ➔ ["1.1 Assembly overview - cylinder head", page 44](#)

Component	Specified torque
Threaded connections for wiring harness.	10 Nm



2 Vacuum system

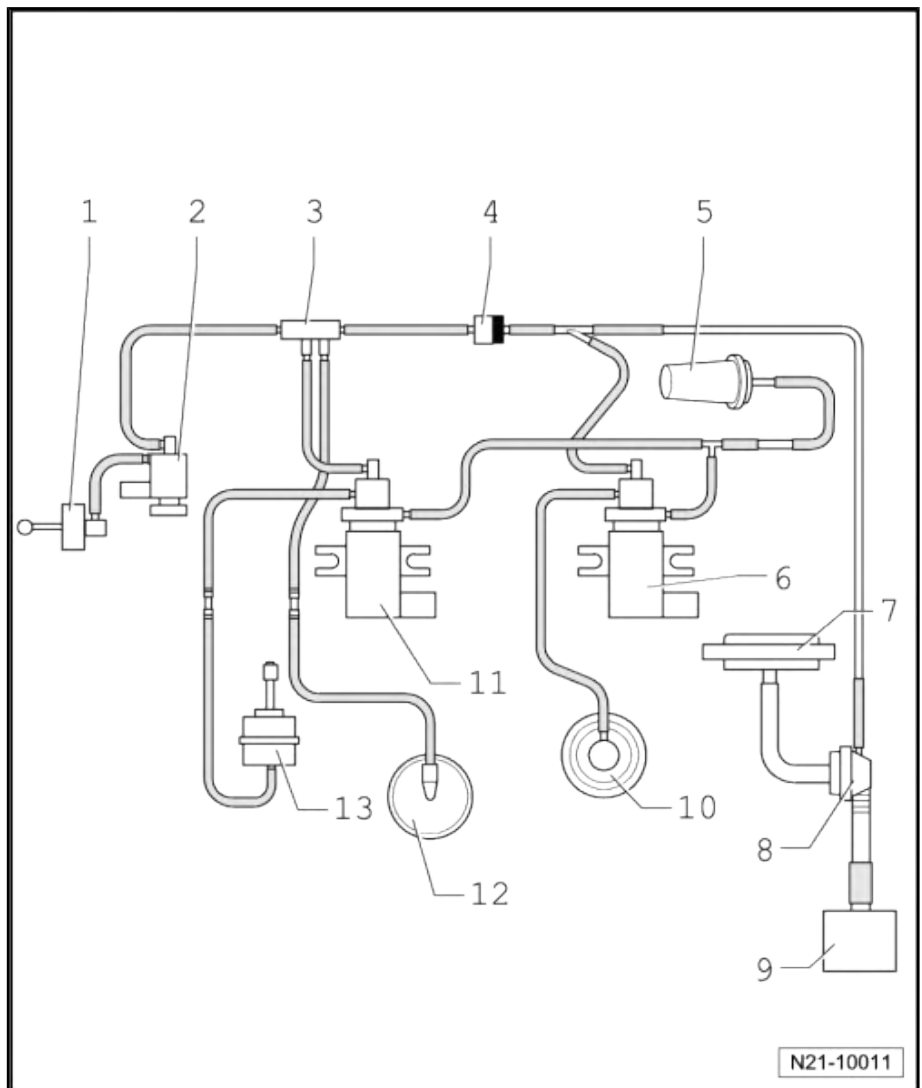
⇒ [“2.1 Vacuum system schematic diagram - engine codes AXB and AXC”, page 151](#)

⇒ [“2.2 Vacuum system schematic diagram - engine codes BRR and BRS, ► 2007”, page 152](#)

⇒ [“2.3 Vacuum system schematic diagram - engine codes BRR and BRS, 2008 ►”, page 153](#)

2.1 Vacuum system schematic diagram - engine codes AXB and AXC

- 1 - Vacuum unit
- 2 - Variable intake manifold flap changeover valve - N239-
- 3 - Junction
- 4 - Non-return valve
- 5 - Filter
- 6 - Exhaust gas recirculation valve - N18-
- 7 - Brake servo
- 8 - Junction
 - ☐ With non-return valve for brake servo.
- 9 - Vacuum pump
- 10 - Mechanical exhaust gas recirculation valve
- 11 - Charge pressure control solenoid valve - N75-
- 12 - Vacuum reservoir
- 13 - Vacuum unit
 - ☐ For charge pressure control.
 - ☐ Integral part of turbo-charger and cannot be replaced individually.





2.2 Vacuum system schematic diagram - engine codes BRR and BRS, ► 2007

1 - Charge pressure control solenoid valve - N75-

2 - Vacuum reservoir

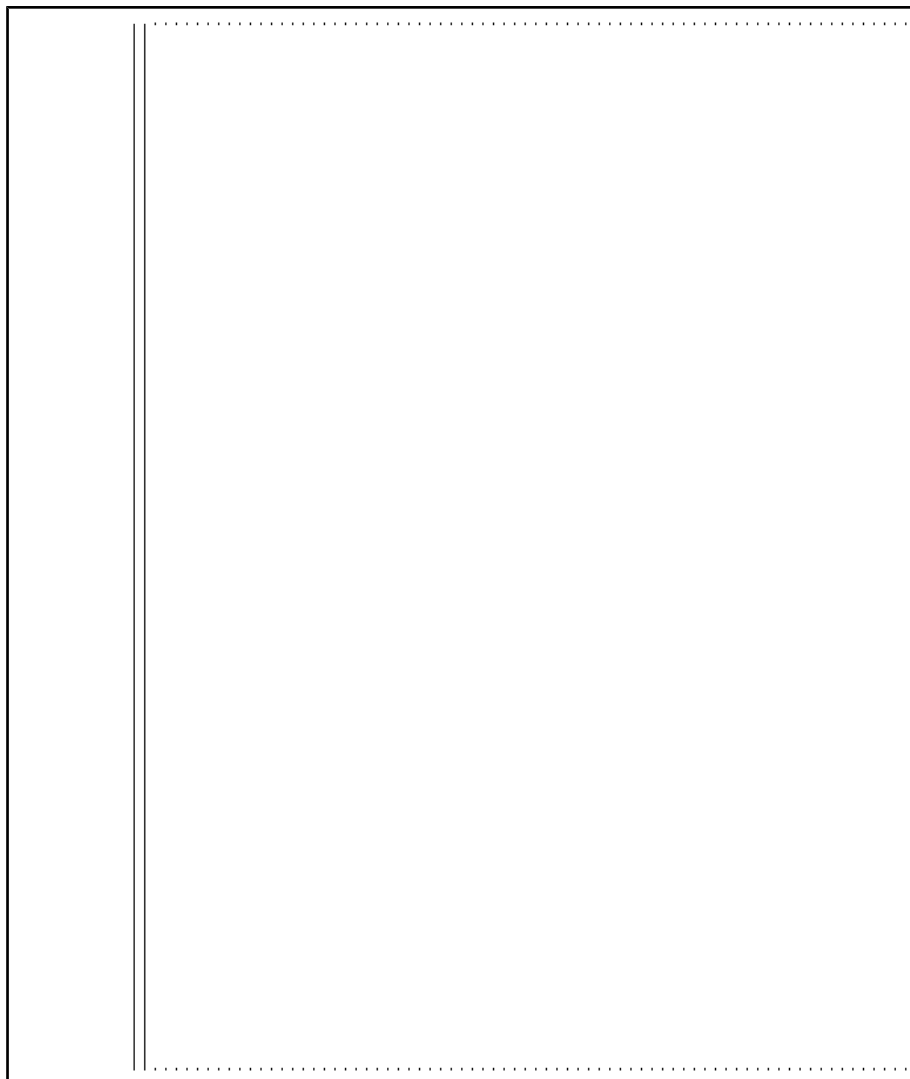
3 - Brake servo line

4 - Non-return valve

- ☐ Note installation position.
- ☐ Black connection faces brake servo line
⇒ [Item 3 \(page 152\)](#)

5 - Air filter

6 - Turbocharger





2.3 Vacuum system schematic diagram - engine codes BRR and BRS, 2008 ►

1 - Charge pressure control solenoid valve - N75-

2 - Non-return valve

- ☐ Note installation position.
- ☐ Black connection faces brake servo line
⇒ [Item 3 \(page 153\)](#)

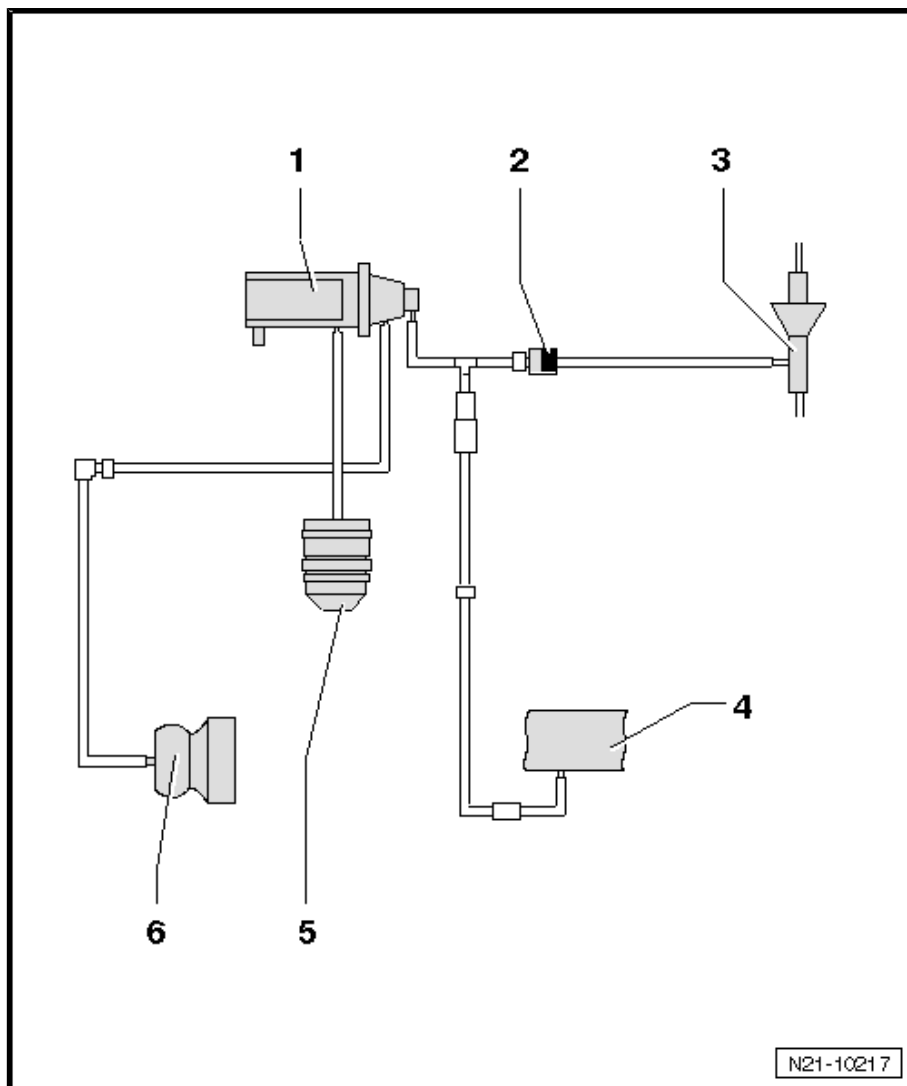
3 - Brake servo line

4 - Vacuum reservoir

- ☐ In cylinder head cover.

5 - Air filter

6 - Turbocharger



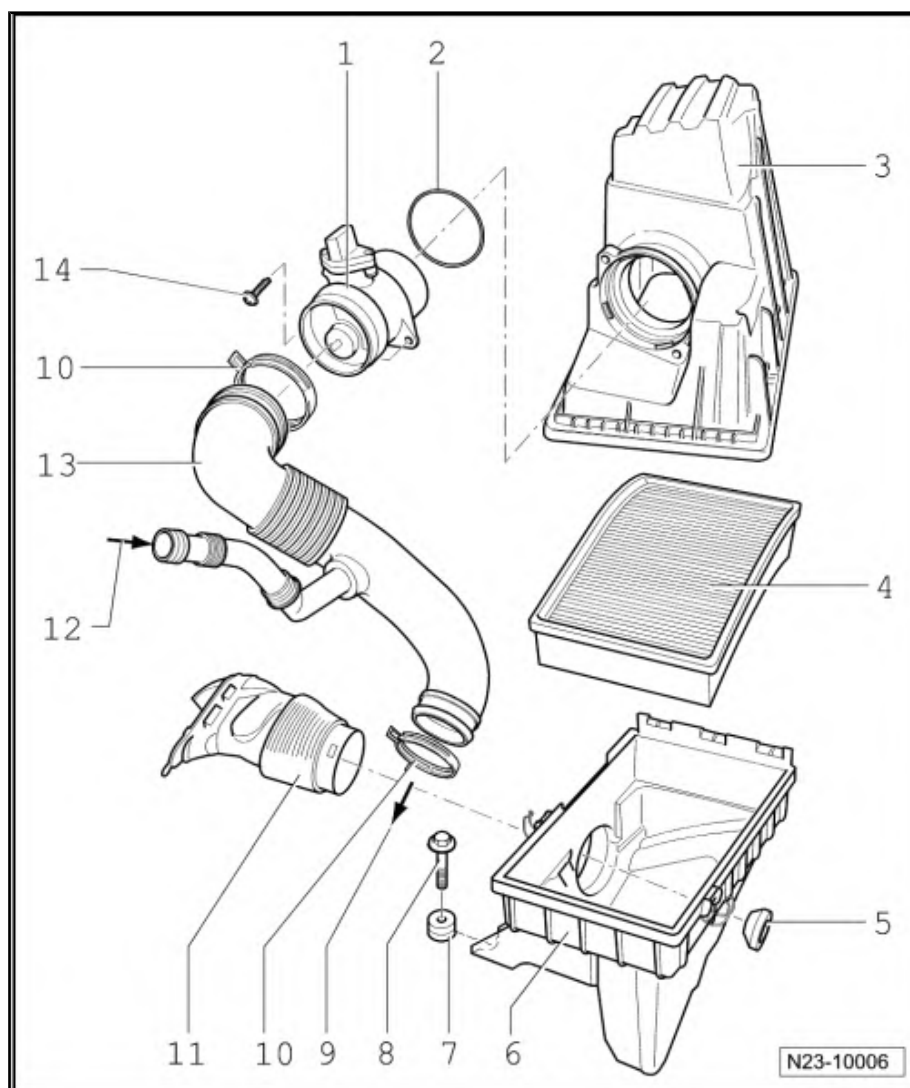


3 Air filter

⇒ “3.1 Assembly overview - air filter”, page 154

3.1 Assembly overview - air filter

- 1 - Air mass meter - G70-
- 2 - O-ring
 - ☐ Renew if damaged.
- 3 - Air filter upper part
- 4 - Filter element
- 5 - Rubber bush
- 6 - Air filter lower part
- 7 - Rubber bush
 - ☐ Clipped into lower part of air filter
- 8 - Bolt
 - ☐ 8 Nm
- 9 - To turbocharger.
- 10 - Spring-type clip
- 11 - Air duct
 - ☐ To lock carrier.
- 12 - From crankcase breather/
cylinder head cover
- 13 - Intake hose
 - ☐ To turbocharger.
- 14 - Bolt
 - ☐ 6 Nm





4 Intake manifold

⇒ ["4.1 Assembly overview - intake manifold, engine codes BRR and BRS", page 155](#)

⇒ ["4.2 Assembly overview - intake manifold, engine codes AXB and AXC", page 155](#)

4.1 Assembly overview - intake manifold, engine codes BRR and BRS

1 - Bolt

- ☐ 9 Nm

2 - Intake manifold flap motor - V157-

- ☐ The intake manifold flap is closed for approx. 3 seconds when stopping engine and then opens again. This reduces the stop jolt.

3 - Seal

- ☐ Renew if damaged.

4 - Intake manifold

- ☐ To remove, remove exhaust gas recirculation cooler ⇒ [page 168](#) and heat shield plate ⇒ [Item 10 \(page 136\)](#).

5 - From exhaust gas recirculation cooler

- ☐ ⇒ [Item 5 \(page 168\)](#)

6 - Gasket

- ☐ Renew after removing.
- ☐ Note installation position.

7 - Bolt

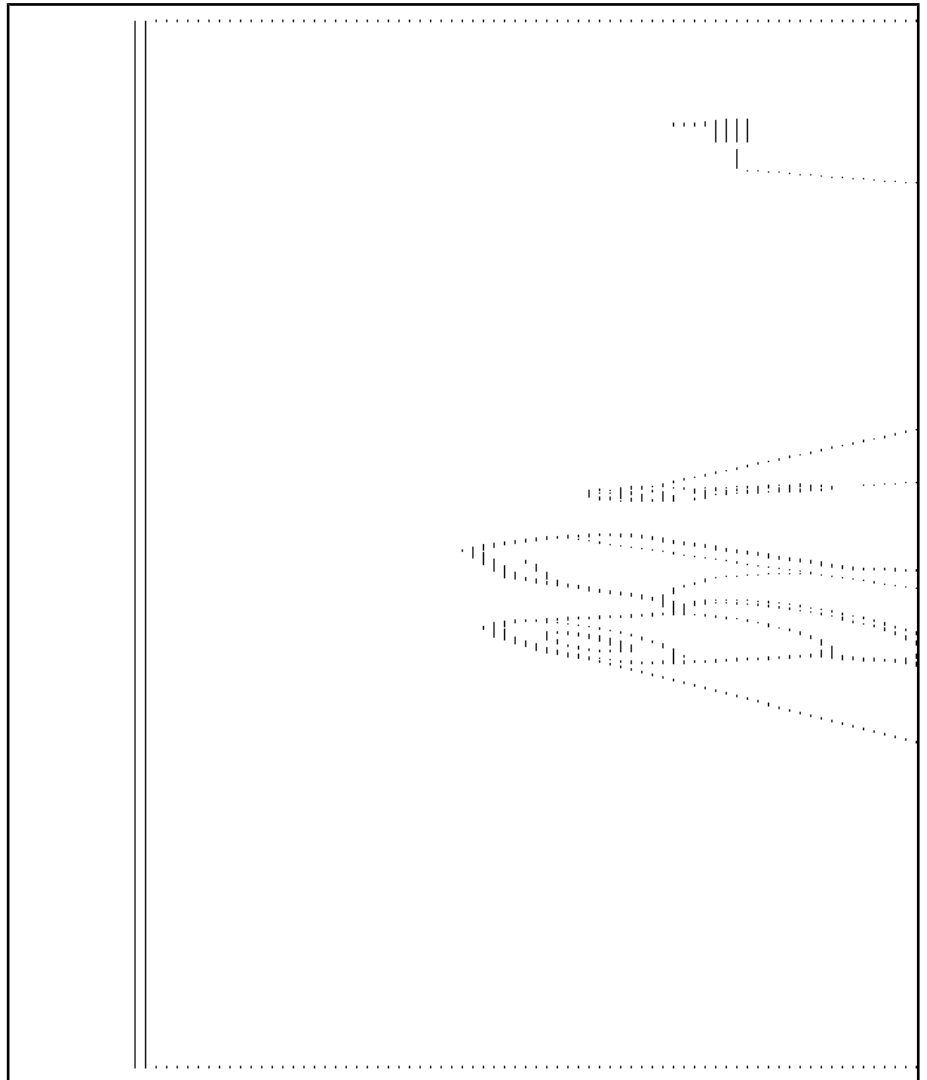
- ☐ 20 Nm

8 - Exhaust gas recirculation valve - N18- with exhaust gas recirculation potentiometer - G212-

- ☐ If renewed, adapt engine control unit to exhaust gas recirculation potentiometer - G212- , ⇒ Vehicle diagnostic tester

9 - Bolt

- ☐ 9 Nm



4.2 Assembly overview - intake manifold, engine codes AXB and AXC

The intake manifold flap is closed for approx. 3 seconds when stopping engine and then opens again. This reduces the stop jolt.



1 - From charge air cooler

2 - Bolt

□ 10 Nm

3 - Intake connecting pipe

□ With mechanical exhaust gas recirculation valve and intake manifold flap

4 - Mechanical exhaust gas recirculation valve

□ Part of intake connecting pipe

5 - O-ring

□ Renew after removing.

6 - Intake manifold

7 - Gasket

□ Renew after removing.

8 - Connecting pipe

□ To exhaust manifold

9 - Bolt

□ 25 Nm

10 - Vacuum supply

□ From vacuum pump

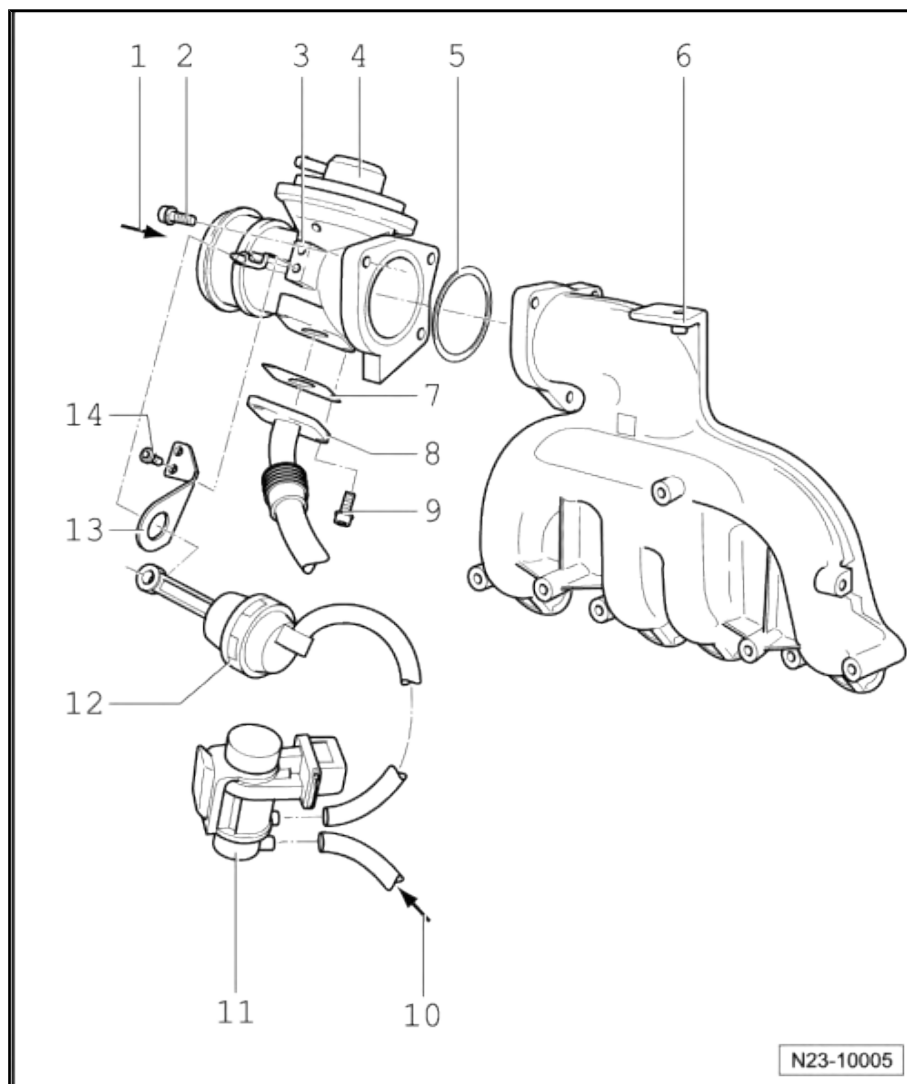
11 - Variable intake manifold flap changeover valve

12 - Vacuum actuator

13 - Bracket

14 - Bolt

□ 10 Nm





5 Engine control unit

⇒ ["5.1 Removing and installing engine control unit", page 157](#)

5.1 Removing and installing engine control unit



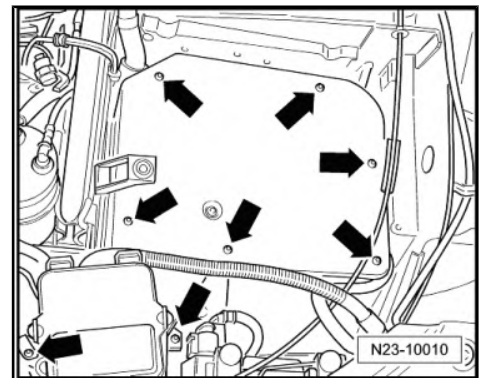
Note

The diesel direct injection system control unit is equipped with an event memory. Read event memory before and after making repairs or adjustments ⇒ Vehicle diagnostic tester.

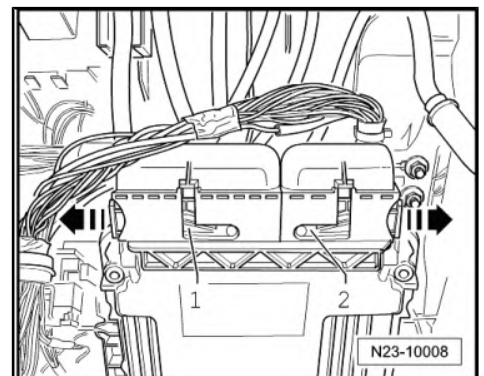
- The control unit identification must be read in order to also read coding of the current control unit before the engine control unit is removed ⇒ Vehicle diagnostic tester.

Removing

- Switch off ignition.
- Remove battery.
- Unscrew securing bolts -arrows- of E box cover.



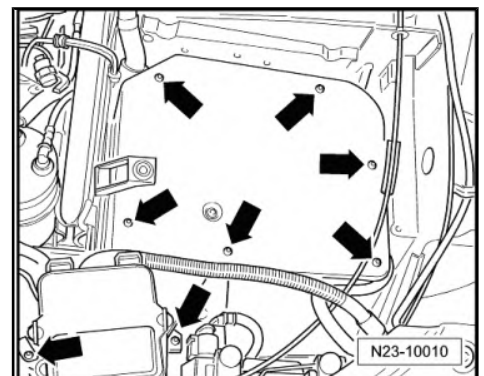
- Release and pull connectors -1- and -2- off engine control unit in direction of arrow.
- Press clip -arrow- outwards and pull control unit out in -direction of arrow-.



Installing

Installation is carried out in the reverse order; note the following:

- Insert new control unit and press downwards until clip engages.
- Attach and lock connectors.
- Install securing bolts -arrows- of E box cover.
- Install battery.
- Check previous coding and code new control unit ⇒ Vehicle diagnostic tester.



Specified torques

- ♦ Battery; Assembly overview - battery ⇒ Electrical system; Rep. gr. 27 ; Assembly overview - battery .
- ♦ Removing and installing relay carrier, fuse holder, E-boxes on left of engine compartment ⇒ Electrical system; Rep. gr. 27 ; Removing and installing E-box on left of engine compartment

26 – Exhaust system

1 Exhaust pipes, silencers

⇒ [“1.1 Assembly overview - silencers/catalytic converters”, page 158](#)

⇒ [“1.2 Assembly overview - silencers/particulate filter”, page 159](#)

⇒ [“1.3 Separating exhaust pipes, silencers”, page 160](#)

1.1 Assembly overview - silencers/catalytic converters

1 - Clip

- ☐ 7 Nm

2 - Gasket

- ☐ Renew after removing.

3 - Front exhaust pipe with catalytic converter

4 - Double clamp

- ☐ M8 = 35 Nm
- ☐ M10 = 52 Nm

5 - Mounting

- ☐ With retaining ring.
- ☐ Renew if damaged.

6 - Bolt

- ☐ 60 Nm

7 - Bolt

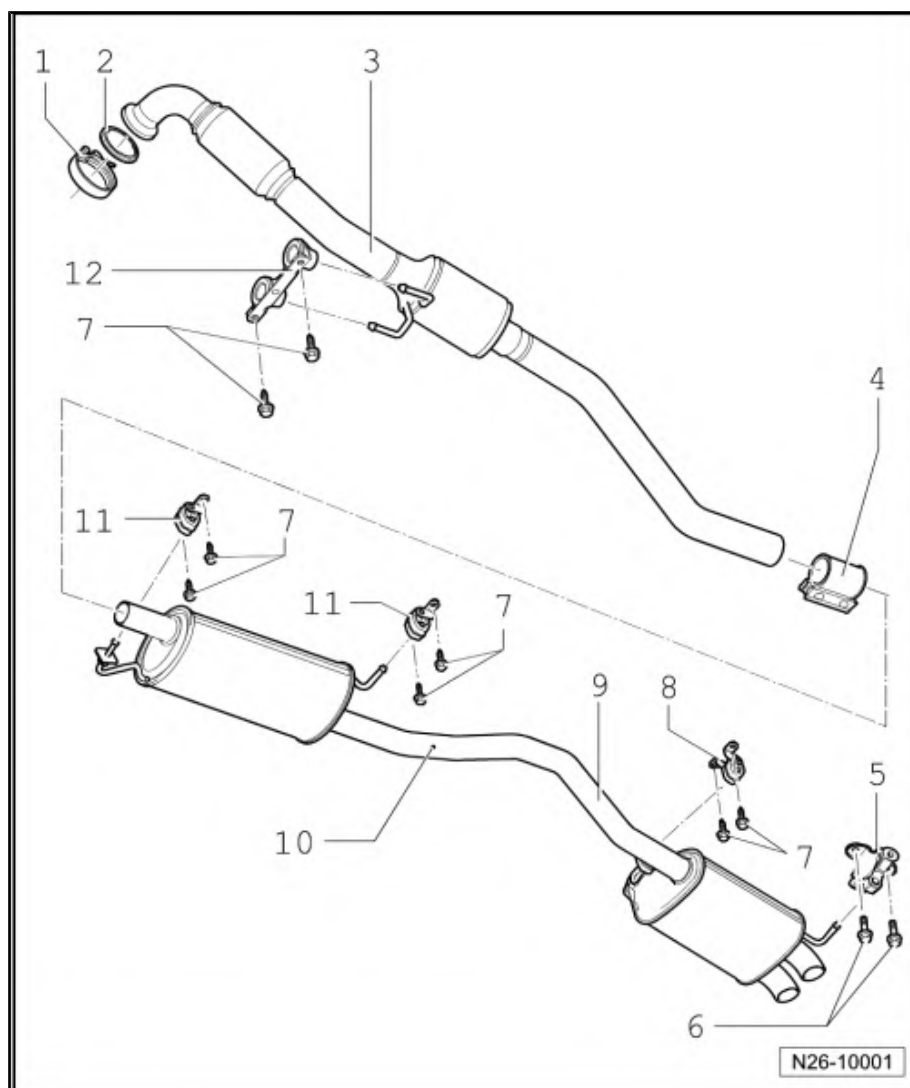
- ☐ 23 Nm

8 - Mounting

- ☐ With retaining ring.
- ☐ Renew if damaged.

9 - Front and rear silencers

- ☐ For repairs, renew individually.
- ☐ Vehicles registered as a commercial vehicle: rear silencer discontinued from approx. model year 2008.
- ☐ Separating front and rear silencers
⇒ [page 160](#).



10 - Separating point

- ☐ For repair cases
- ☐ During production, front and rear silencers are installed as a single component. In cases of repair, the front and rear silencers are supplied individually and with a double clamp for connecting.
- ☐ Separating front and rear silencers ⇒ [page 160](#).

11 - Mounting

- ☐ With retaining ring.
- ☐ Renew if damaged.



12 - Mounting for front exhaust pipe

- ☐ Renew if damaged.

1.2 Assembly overview - silencers/particulate filter

1 - Mounting

2 - Bolt

- ☐ 25 Nm

3 - Bolt

- ☐ 25 Nm

4 - From particulate filter

5 - Gasket

- ☐ Renew after removing.

6 - Connecting clamp

- ☐ Note installation position.
- ☐ 7 Nm

7 - Front exhaust pipe

8 - Mounting

9 - Bolt

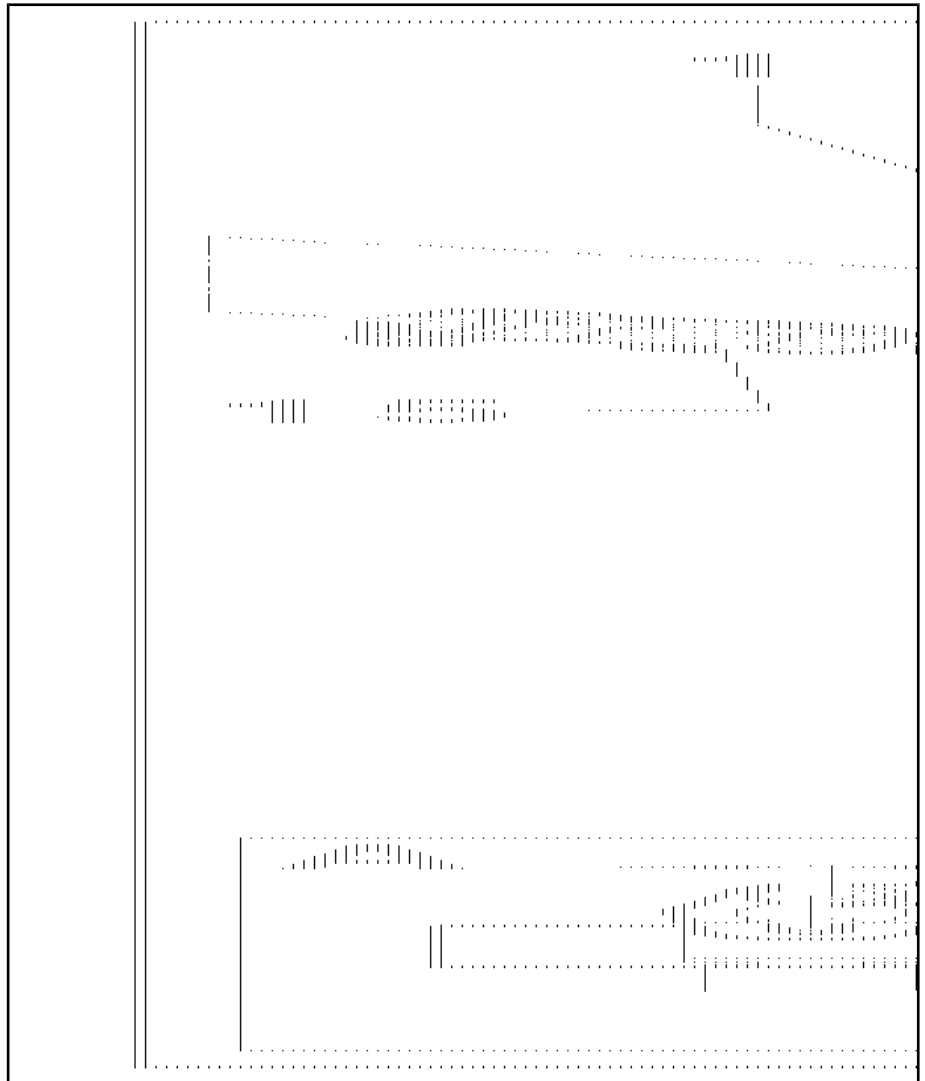
- ☐ 60 Nm

10 - Rear silencer

- ☐ Vehicles registered as a commercial vehicle: rear silencer discontinued from approx. model year 2008.

11 - Alignment dimensions in mm

- ☐ -a- = approx. 5 mm.
- ☐ -b- = approx. 11.
- ☐ Exhaust system must be cold
- ☐ Arrow indicates front of vehicle.



12 - Separating point for silencer

- ☐ For repair cases
- ☐ During production, front and rear silencers are installed as a single component. In cases of repair, the front and rear silencers are supplied individually and with a double clamp for connecting.
- ☐ Separating front and rear silencers ⇒ [page 160](#).

13 - Alignment dimensions in mm

- ☐ -a- = approx. 9 mm.
- ☐ -b- = approx. 7.
- ☐ Exhaust system must be cold
- ☐ Arrow indicates front of vehicle.

14 - Front silencer

15 - Clip

- ☐ Note installation position.

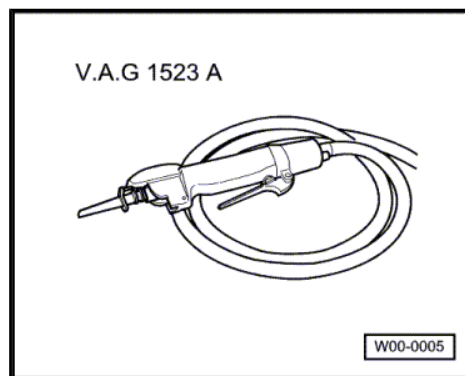


- ❑ M8 = 35 Nm
- ❑ M10 = 52 Nm

1.3 Separating exhaust pipes, silencers

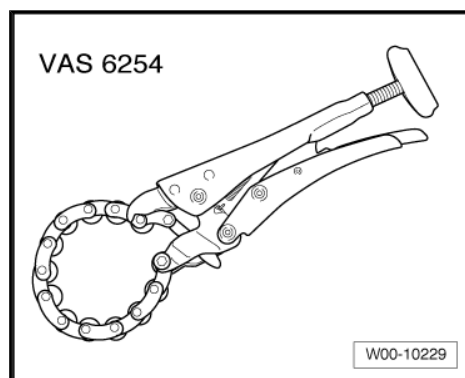
Special tools and workshop equipment required

- ◆ Pneumatic sabre saw - V.A.G 1523A-



or

- ◆ Chain-type pipe cutter - VAS 6254-
- ◆ Eye protection



WARNING

To avoid injury from metal shavings, wear eye protection and protective clothing.

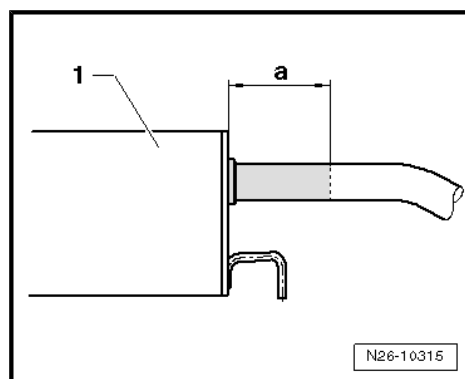


Note

- ◆ *After working on the exhaust system, ensure that the system is not under stress and that there is sufficient clearance to the bodywork. If necessary, loosen double and single clamps and align silencer and exhaust pipe so that sufficient clearance is maintained to the bodywork and the support rings are evenly loaded.*
- ◆ *Renew self-locking nuts.*

Procedure

- Mark cutting location -a- = 144 mm on front silencer exhaust pipe -1-.
- Cut through exhaust pipe at cutting location at right angle to pipe using e.g. pneumatic sabre saw - VAS 6254- .

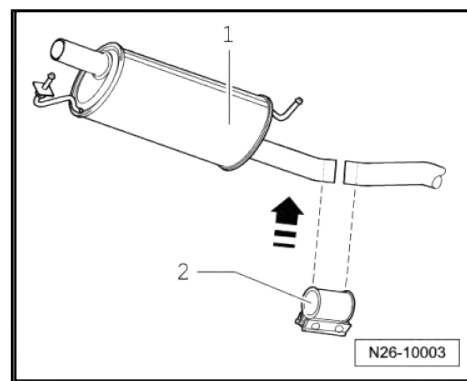




- Centre repair double clamp -2- when installing.
- Align exhaust system such that it is not under tension.

Specified torques

- ◆ ⇒ [“1.1 Assembly overview - silencers/catalytic converters”, page 158](#)
- ◆ ⇒ [“1.2 Assembly overview - silencers/particulate filter”, page 159](#)





2 Cleansing exhaust emissions

⇒ ["2.1 Assembly overview - cleansing exhaust emissions", page 162](#)

⇒ ["2.2 Removing and installing particulate filter", page 163](#)

2.1 Assembly overview - cleansing exhaust emissions

1 - Bolt

- ☐ 9 Nm

2 - Exhaust gas pressure sensor 1 - G450-

3 - Hose

4 - Control pipe

- ☐ 45 Nm

5 - Control pipe

- ☐ 45 Nm

6 - Clip

7 - Bolt

- ☐ 9 Nm

8 - Exhaust gas temperature sender 3 - G495-

- ☐ 45 Nm

9 - Bolt

- ☐ 60 Nm

10 - Particulate filter

- ☐ Removing and installing
⇒ [page 163](#) .

11 - To front exhaust pipe

- ☐ ⇒ [Item 7 \(page 159\)](#)

12 - Bolt

- ☐ 50 Nm + 90°

13 - Bracket

- ☐ Adhere to installation
sequence:

◆ Tighten bolts

⇒ [Item 12 \(page 162\)](#) and ⇒ [Item 14 \(page 162\)](#) hand-tight.

◆ First tighten bolt ⇒ [Item 14 \(page 162\)](#) , then bolt ⇒ [Item 12 \(page 162\)](#) .

◆ Install particulate filter ⇒ [page 163](#)

◆ First retighten bolt ⇒ [Item 14 \(page 162\)](#) , then bolt ⇒ [Item 12 \(page 162\)](#) .

14 - Bolt

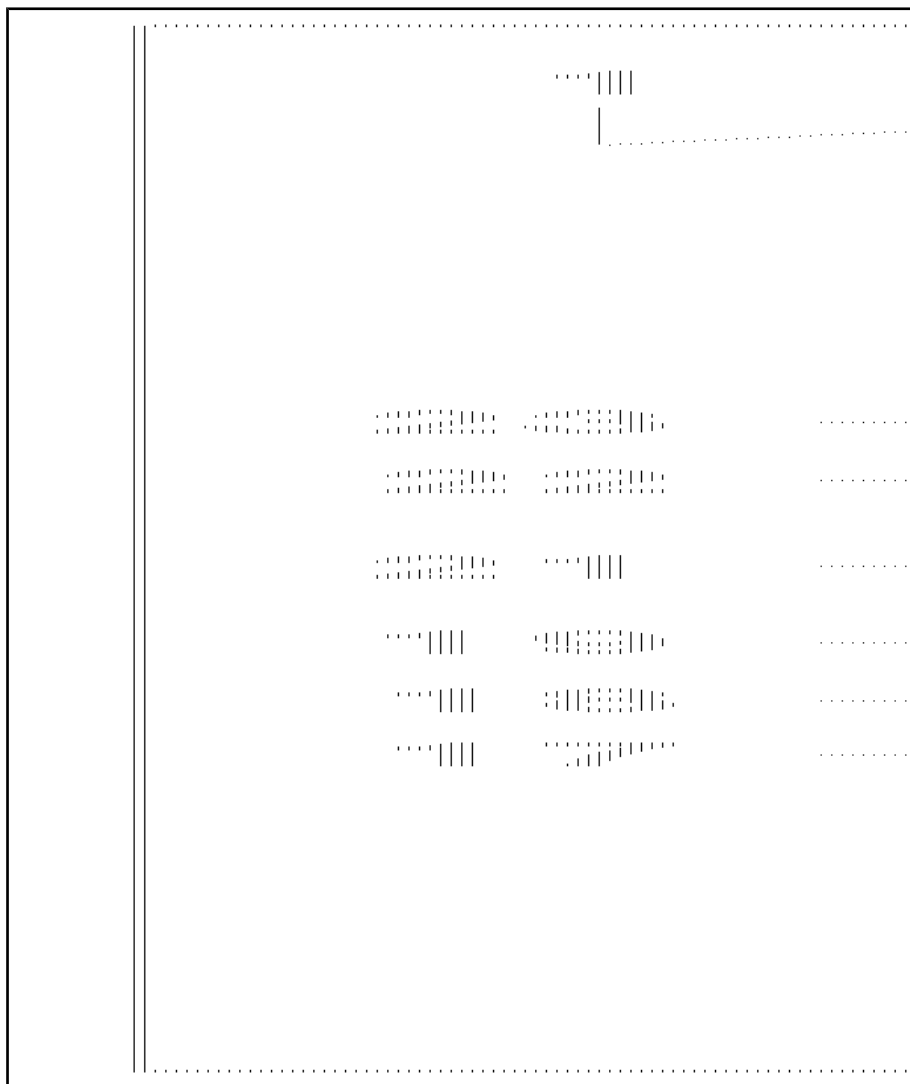
- ☐ 50 Nm + 90°

15 - Bolt

- ☐ 60 Nm

16 - Support

- ☐ Between particulate filter and cylinder block.





17 - Lambda probe - G39-

- ☐ Grease only the threads with high-temperature paste ; high-temperature paste ⇒ Electronic Parts Catalogue (ETKA) must not get into the slots of probe body.
- ☐ 52 Nm

18 - Gasket

- ☐ Renew after removing.
- ☐ Note installation position.

19 - Connecting clamp

- ☐ Note installation position.
- ☐ 7 Nm

20 - From turbocharger

- ☐ ⇒ [Item 25 \(page 134\)](#)

21 - Exhaust gas temperature sender 2 - G448-

- ☐ 45 Nm

22 - Clip

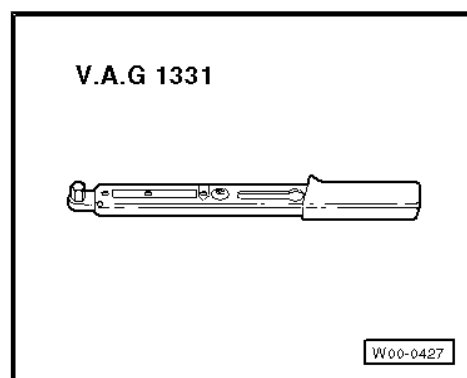
23 - Bolt

- ☐ 9 Nm

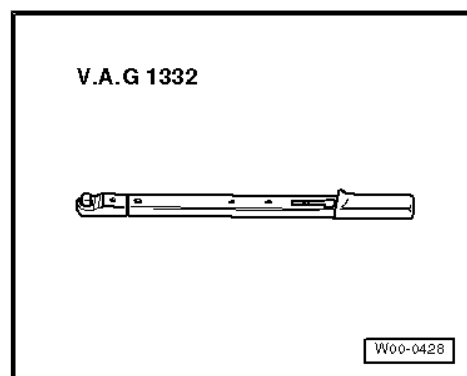
2.2 Removing and installing particulate filter

Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1331-



- ◆ Torque wrench - V.A.G 1332-





Removing



Note

- ◆ *After working on the exhaust system, ensure that the system is not under stress and that there is sufficient clearance to the bodywork. If necessary, loosen double and single clamps and align silencer and exhaust pipe so that sufficient clearance is maintained to the bodywork and the support rings are evenly loaded.*
- ◆ *Renew self-locking nuts.*



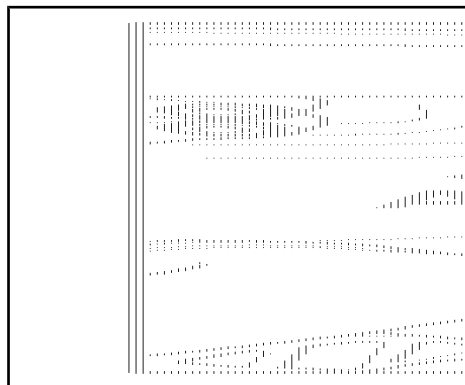
WARNING

Risk of burns.

Parts of the exhaust system may be hot.

Allow exhaust system to cool before removing.

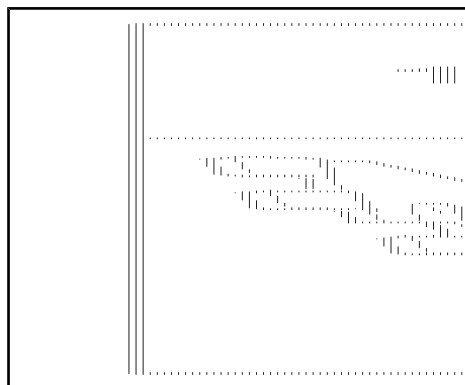
- Unplug connectors -arrow A- and Lambda probe - G39- connector -arrow B- in engine compartment.
- Release cable tie.



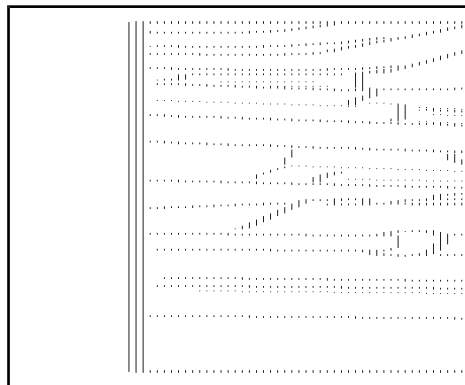
- Unplug connector to exhaust pressure sensor 1 - G450- -2- and unscrew bolt -1-.

The hoses remain connected to exhaust gas pressure sensor 1 - G450- .

- Unclip hoses from brackets.
- Loosen connecting clamp between particulate filter and turbocharger.
- Release clamp-type clip to centre silencer.

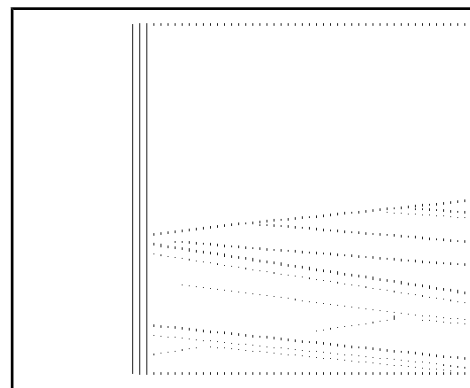


- Remove front exhaust pipe by removing clamp -1- and unscrewing bolts -arrows-.





- Unscrew bolts -arrows- and remove bracket -1-.



- Unscrew bolts -arrows- from particulate filter and remove particulate filter.

Pay attention to lines and hoses when removing.

Installing

Installation is carried out in the reverse order; note the following:

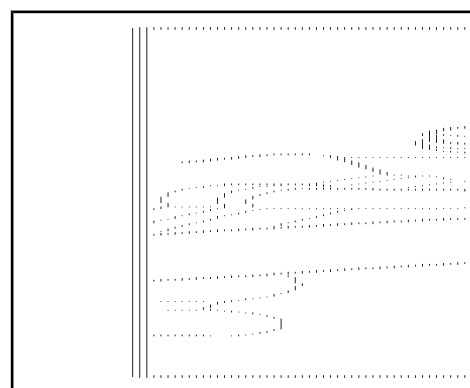


Caution

Ensure that the particulate filter is not installed under stress.

The particulate filter could be damaged.

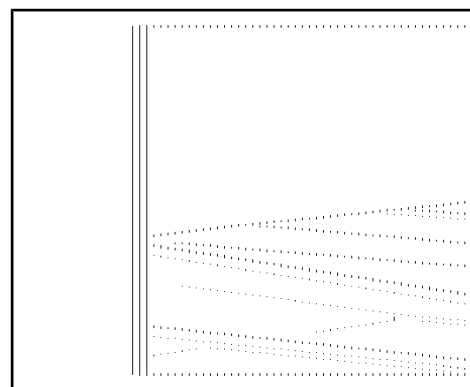
Follow the installation sequence.



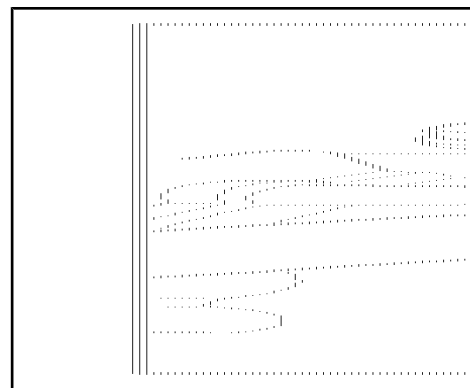
- Place bracket -1- against particulate filter so that bracket can still be moved.
- Place particulate filter with new gasket against turbocharger and place it on the bracket => [Item 13 \(page 162\)](#) .

Pay attention to lines and hoses.

- Tighten clamp between turbocharger and particulate filter.



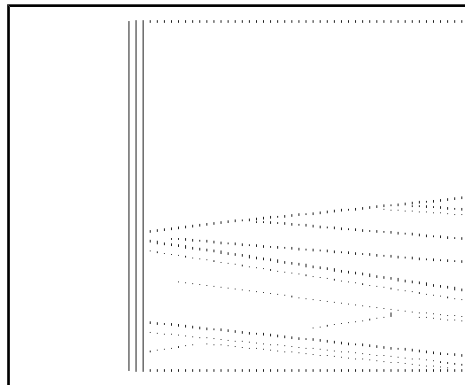
- Tighten securing bolts -arrows- of particulate filter.



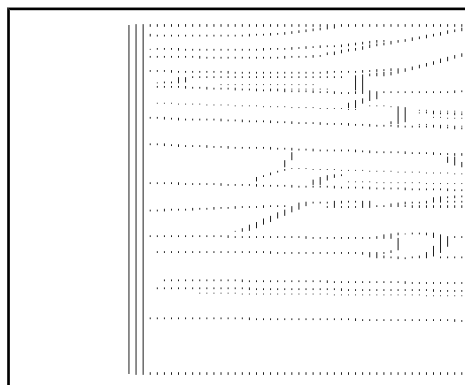


Fit bolt -1- of bracket on cylinder block.

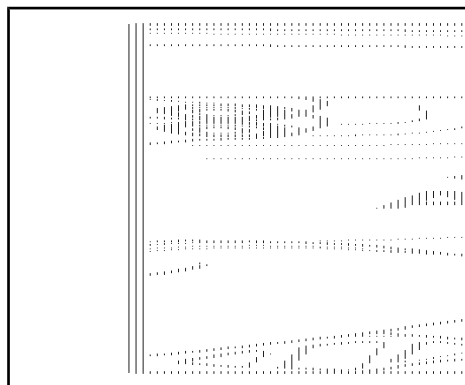
- Tighten bolts -arrows-, first on particulate filter and then on cylinder block.
- Install front exhaust pipe.



- Tighten bolts -arrows-.
- Tighten clamp -1-.
- Screw on exhaust gas pressure sensor 1 - G450- and connect connector.
- Clip hoses onto bulkhead.



- Fit connectors -A- and -B-. Secure wiring harness with cable ties at positions marked.



Note

If a new particulate filter was installed, an "ash mass comparison" must be carried out ⇒ Vehicle diagnostic tester.

Specified torques

- ◆ ⇒ ["2.1 Assembly overview - cleansing exhaust emissions", page 162](#)
- ◆ ⇒ ["1.2 Assembly overview - silencers/particulate filter", page 159](#)



3 Exhaust gas recirculation

⇒ ["3.1 Assembly overview - exhaust gas recirculation, engine codes AXB and AXC", page 167](#)

⇒ ["3.2 Assembly overview - exhaust gas recirculation, engine codes BRR and BRS", page 168](#)

3.1 Assembly overview - exhaust gas recirculation, engine codes AXB and AXC



Note

- ◆ The exhaust gas recirculation system is activated from the diesel direct injection control unit - J248- to the exhaust gas recirculation valve - N18-.
- ◆ The tapered plunger in the mechanical exhaust gas recirculation valve varies the opening cross-section according to the opening lift.
- ◆ Pulsed control enables every conceivable valve position.
- ◆ Renew self-locking nuts.

1 - From charge air cooler

2 - Bolt

- 10 Nm

3 - Intake connecting pipe

- With mechanical exhaust gas recirculation valve and intake manifold flap

4 - Mechanical exhaust gas recirculation valve

- Part of intake connecting pipe

5 - O-ring

- Renew after removing.

6 - Intake manifold

7 - Exhaust manifold

8 - Gasket

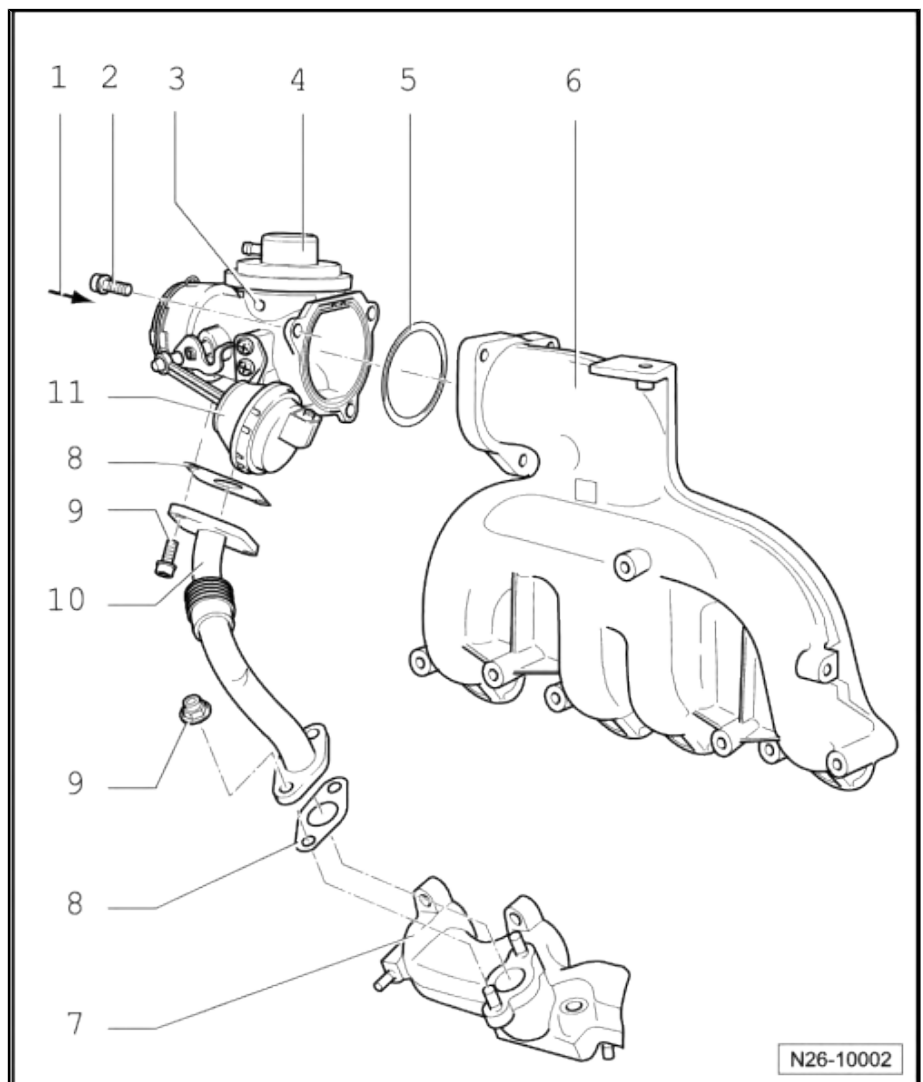
- Renew after removing.

9 - Nut

- 25 Nm

10 - Connecting pipe

11 - Vacuum actuator



N26-10002



3.2 Assembly overview - exhaust gas recirculation, engine codes BRR and BRS



Note

- ◆ *The exhaust gas recirculation system is activated by the engine control unit - J623- via the exhaust gas recirculation potentiometer - G212- .*
- ◆ *Renew self-locking nuts.*

1 - To intake manifold.

- ☐ ➔ [page 155](#)

2 - Gasket

- ☐ Renew after removing.

3 - Connecting pipe

4 - Bolt

- ☐ 20 Nm

5 - Exhaust gas recirculation cooler

6 - Bolt

- ☐ 9 Nm

7 - From exhaust manifold

- ☐ ➔ [Item 3 \(page 135\)](#)

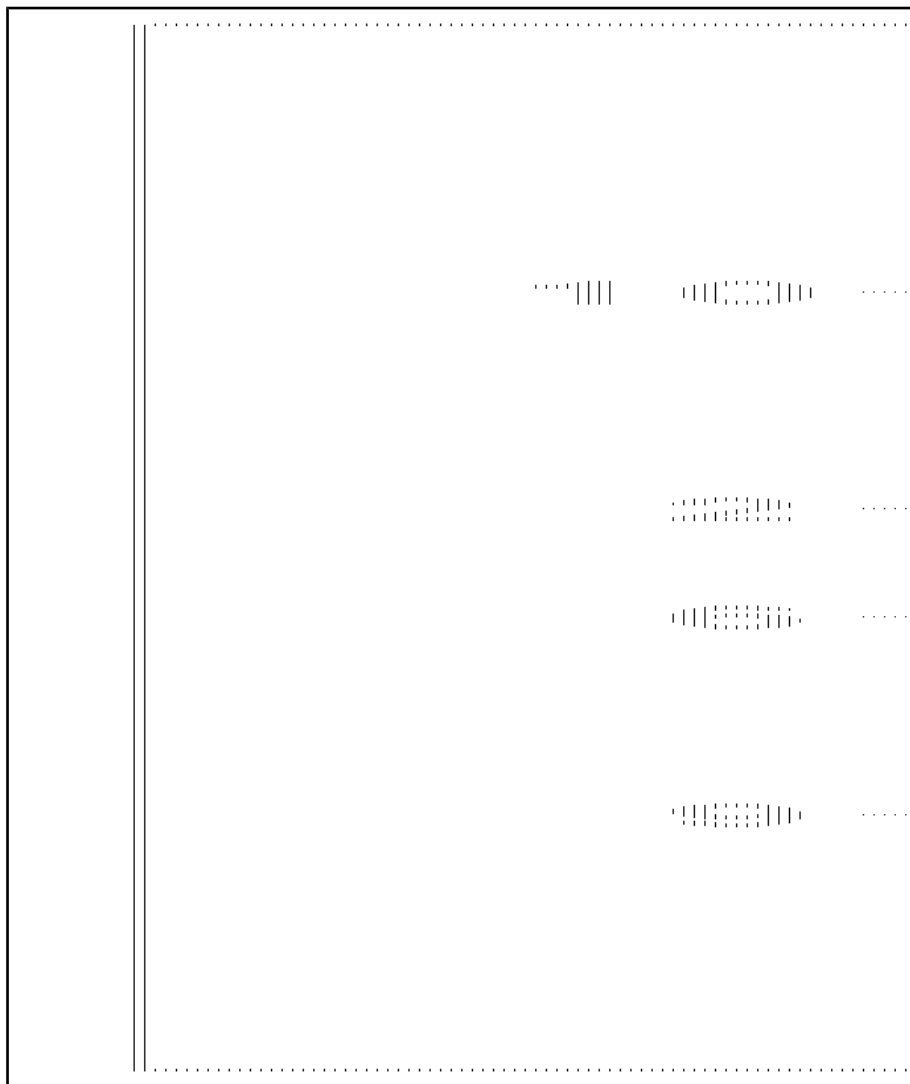
8 - Nut

- ☐ 20 Nm

9 - Connecting pipe

10 - Coolant hose

- ☐ Coolant hose schematic diagram ➔ [page 107](#) .





28 – Glow plug system

1 Glow plug system

⇒ [“1.1 Checking metal glow plugs”, page 169](#)

⇒ [“1.2 Removing and installing engine speed sender G28”, page 170](#)

⇒ [“1.3 Removing and installing Hall sender G40”, page 171](#)

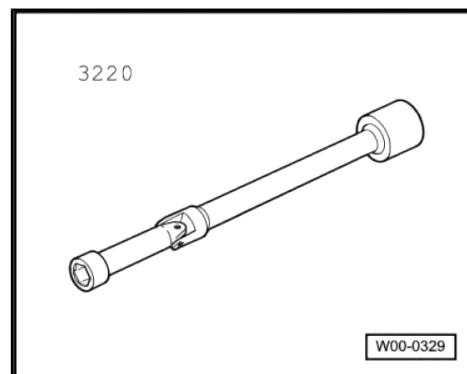
1.1 Checking metal glow plugs

Special tools and workshop equipment required

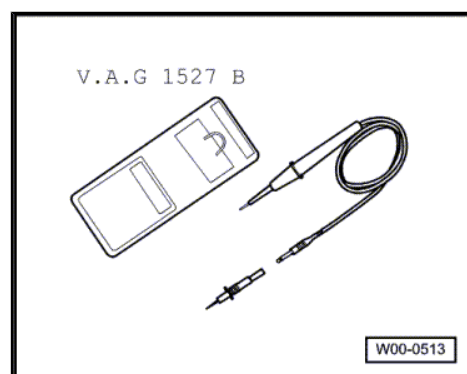
◆ Auxiliary measuring set - V.A.G 1594C-



◆ Jointed wrench 10 mm - 3220-



◆ Voltage tester - V.A.G 1527B-





Distinguishing characteristics of glow plugs:

A - Ceramic glow plug: white colour code -arrow- with shoulder on the tip (close-up)

B - Metal glow plug, green colour code -arrow-



Note

Check ceramic glow plugs only using ⇒ *Vehicle diagnostic tester*.

Test prerequisites

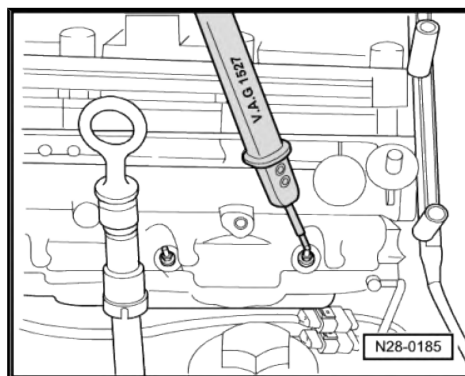
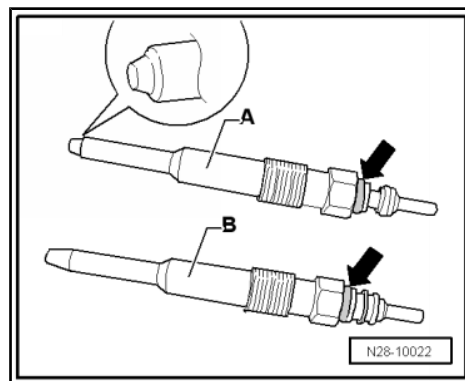
- Battery voltage at least 11.5 V
- Ignition switched off
- Fuse for glow plugs OK.

Test procedure

- Pull connectors off glow plugs.
- Connect voltage tester - V.A.G 1527B- cable to battery positive (+), using clips from auxiliary measuring set - V.A.G 1594C- .
- Place test probe of voltage tester - V.A.G 1527B- on each glow plug one after the other. Diode lights up: glow plug OK., diode does not light up: renew glow plug.
- Use U/J extension and socket, 10 mm - 3220- to remove and install glow plugs.

Specified torques

- ♦ ⇒ ["1.1 Assembly overview - cylinder head", page 44](#)



1.2 Removing and installing engine speed sender - G28-

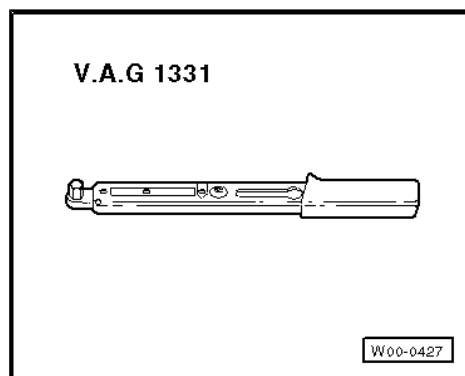


Note

Removing and installing engine speed sender - G28- , engine codes AXB and AXC ⇒ [Item 8 \(page 16\)](#) .

Special tools and workshop equipment required

- ♦ Torque wrench - V.A.G 1331-



Removing

- Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Body, front; Noise insulation .



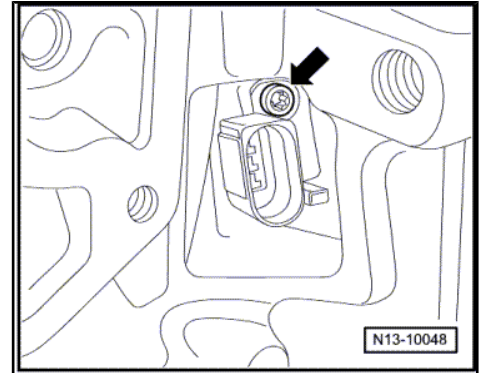
- Remove engine oil cooler ➔ [page 100](#) .
- Pull connector off engine speed sender - G28- .
- Unscrew securing bolt -arrow- and pull out engine speed sender - G28- .

Installing

Installation is carried out in the reverse order; note the following:

Specified torques

- ◆ ➔ [“2.1 Assembly overview - cylinder block, gearbox end”, page 26](#)
- ◆ ➔ [“2.1 Assembly overview - oil filter housing, oil pressure switch”, page 100](#)
- ◆ Noise insulation; Assembly overview - noise insulation ➔ Rep. gr. 50 ; Assembly overview - noise insulation



1.3 Removing and installing Hall sender - G40-

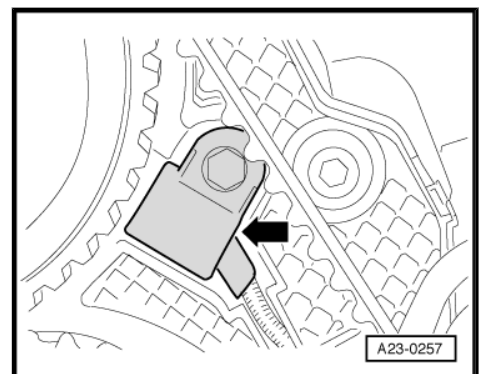
Removing

- Remove pressure pipe ➔ [page 139](#) .
- Remove toothed belt guard upper part ➔ [page 64](#) .
- Screw off Hall sender - G40- -arrow-.



Note

Item -1- can be disregarded.



- Unclip and remove wiring -arrows- from guide and remove cover cap -2-.
- Remove Hall sender - G40- from cylinder head, disconnect connector, pull connector out of holder and remove Hall sender - G40- .

Installing

Installation is carried out in the reverse order; note the following:

- Seal repair aperture in toothed belt guard with rubber plugs as specified in ➔ Electronic Parts Catalogue (ETKA) .
- Install pressure pipe ➔ [page 139](#) .
- Install toothed belt guard upper part ➔ [page 64](#) .

Specified torques

- ◆ ➔ [“1.1 Assembly overview - cylinder head”, page 44](#)

